# K-Jetronic and L-Jetronic

Export vehicles for countries with stringent exhaust emission regulations are equipped with various emission control systems. To meet the legal requirements, these systems are installed either individually or in combination, depending on the model version.

| Emission control system | installed predominantly in export vehicles | | | | |
|---|---|---|---|---|---|
| | Sweden | Australia | Canada | USA | Japan |
| Exhaust-gas recirculation* | ● | ● | ● | (●) | (○) |
| Secondary-air induction* | ● | ● | ○ | (●) | (○) |
| Secondary-air injection* | ● | ● | ● | (●) | (○) |
| Catalytic converter* | - | - | - | ● | ● |
| Lambda closed-loop control | - | - | - | ● | ○ |

The vehicle-related After-Sales Service Instruction Manuals for the K-Jetronic and L-Jetronic describe the construction, function and operating principle of the emission control systems. The influence of these systems should be borne in mind particularly when adjusting the idle speed and CO concentration.

Export vehicles are sometimes also encountered in countries which do not have particularly stringent exhaust emission legislation. This Service Information publication summarizes the various emission control systems and provides information for the After-Sales Service in countries with exhaust emission legislation which does not require such emission control systems or unleaded fuel.

* Not made by Bosch

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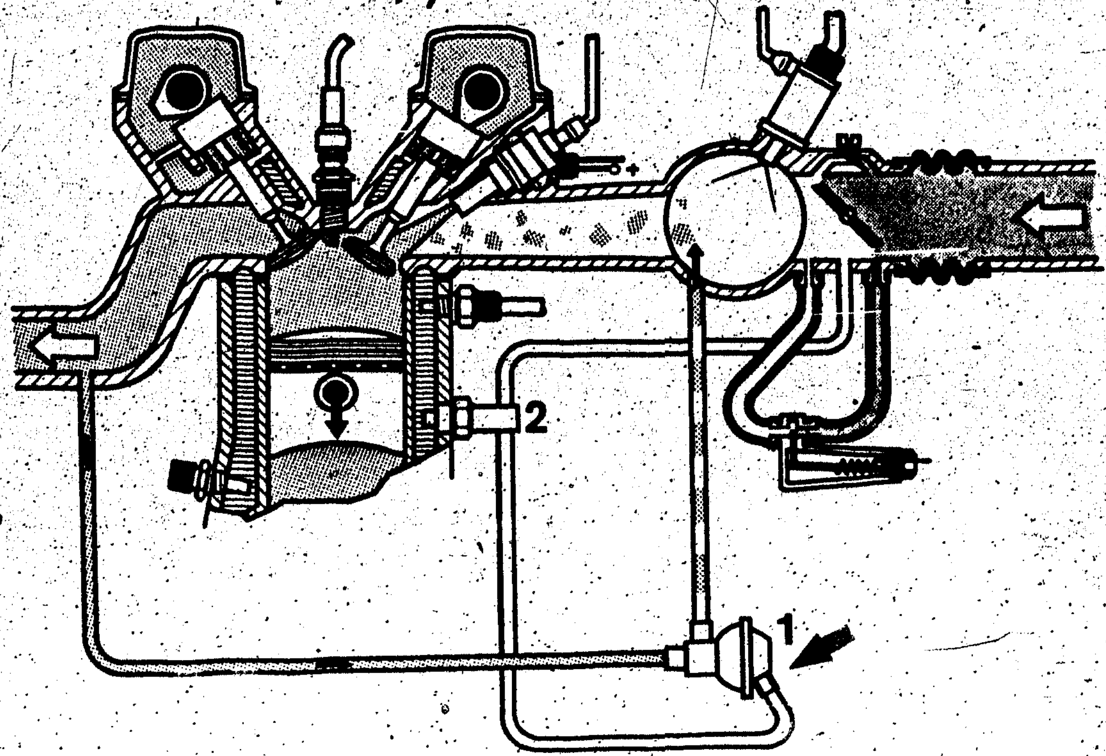
## 1. Exhaust-gas recirculation (EGR)



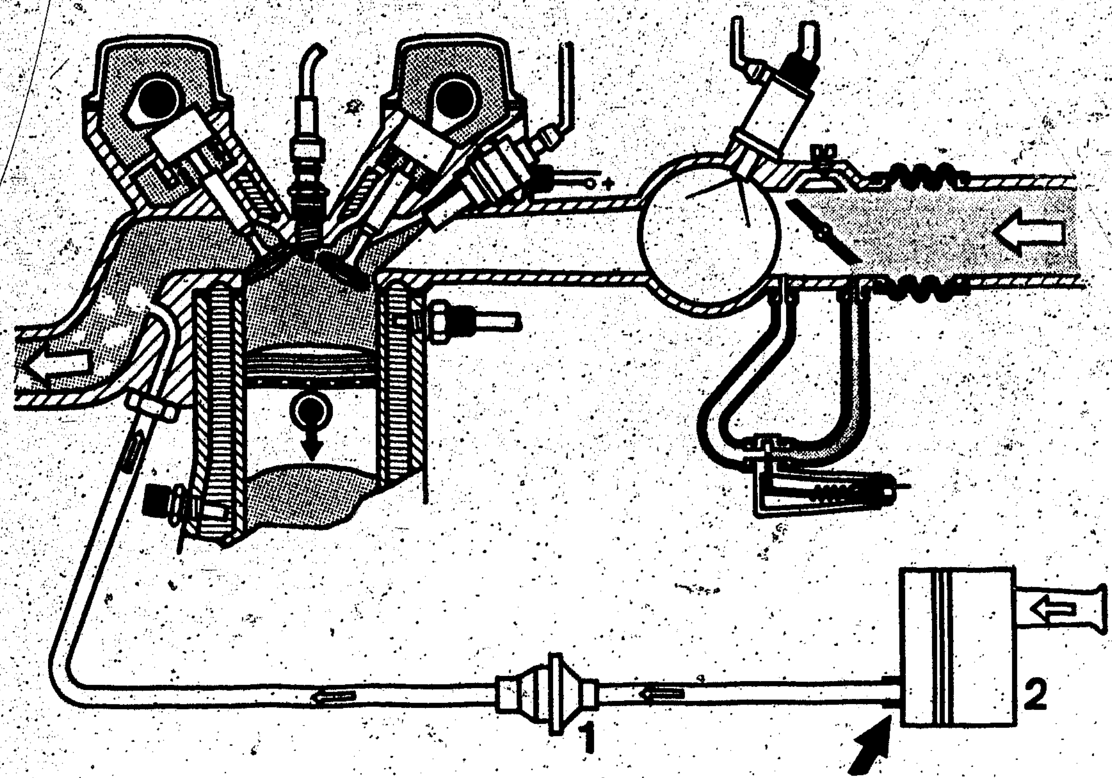

1 = Exhaust-gas recirculation valve    2 = Thermo-valve

Some of the exhaust gas is returned to the intake manifold via a vacuum-controlled exhaust-gas recirculation valve. This recirculation of exhaust gas into the combustion chamber lowers the combustion temperature and reduces the emission of nitrogen oxides (NOx). The thermo-valve and the position of the vacuum tapping port on the throttle-valve assembly ensure that exhaust gas is only recirculated when the engine is warm and only at part load. There is a reduction in engine speed of about 200 $min^{-1}$. Exhaust-gas recirculation is inoperative at idle, full-load and when the engine is cold.

When testing or adjusting the idle speed and CO concentration, remove and seal off the vacuum control line (arrow) on the exhaust-gas recirculation valve in order to ensure that the exhaust-gas recirculation system is inoperative.

In countries without stringent exhaust emission legislation it is not necessary to shut down the system.

2. Secondary-air induction (e.g. Volvo Pulsair system)



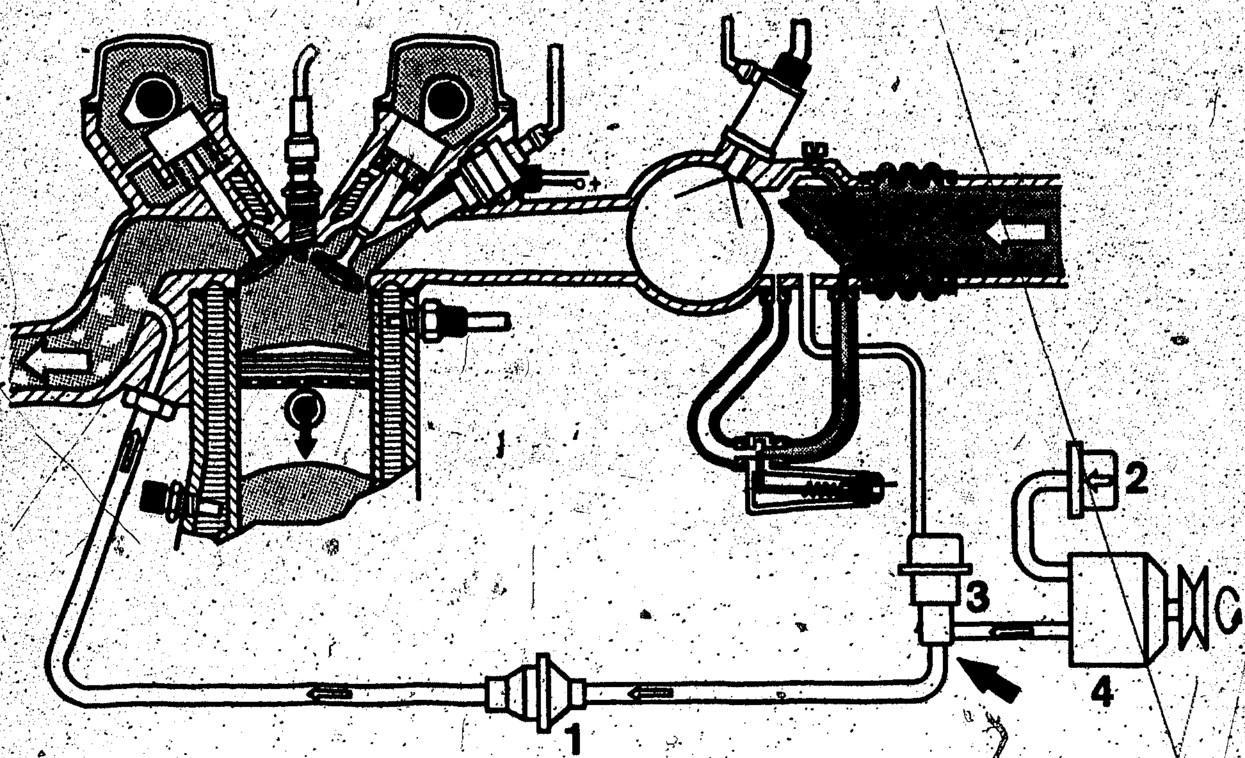

1 = Non-return valve 2 = Air filter

The pulsating alternation between overpressure and depression in the flow of exhaust gas inducts fresh air into the exhaust ports via a non-return valve. Unburned residues of carbon monoxide (CO) and hydrocarbons (HC) are partially after-burned, leading to fewer pollutants in the exhaust gas.

When testing or adjusting the idle speed and the CO concentration, the secondary-air induction system must be rendered inoperative. To do this, remove the hose between the non-return valve and the air filter on the air filter (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air induction system.

## 3. Secondary-air injection



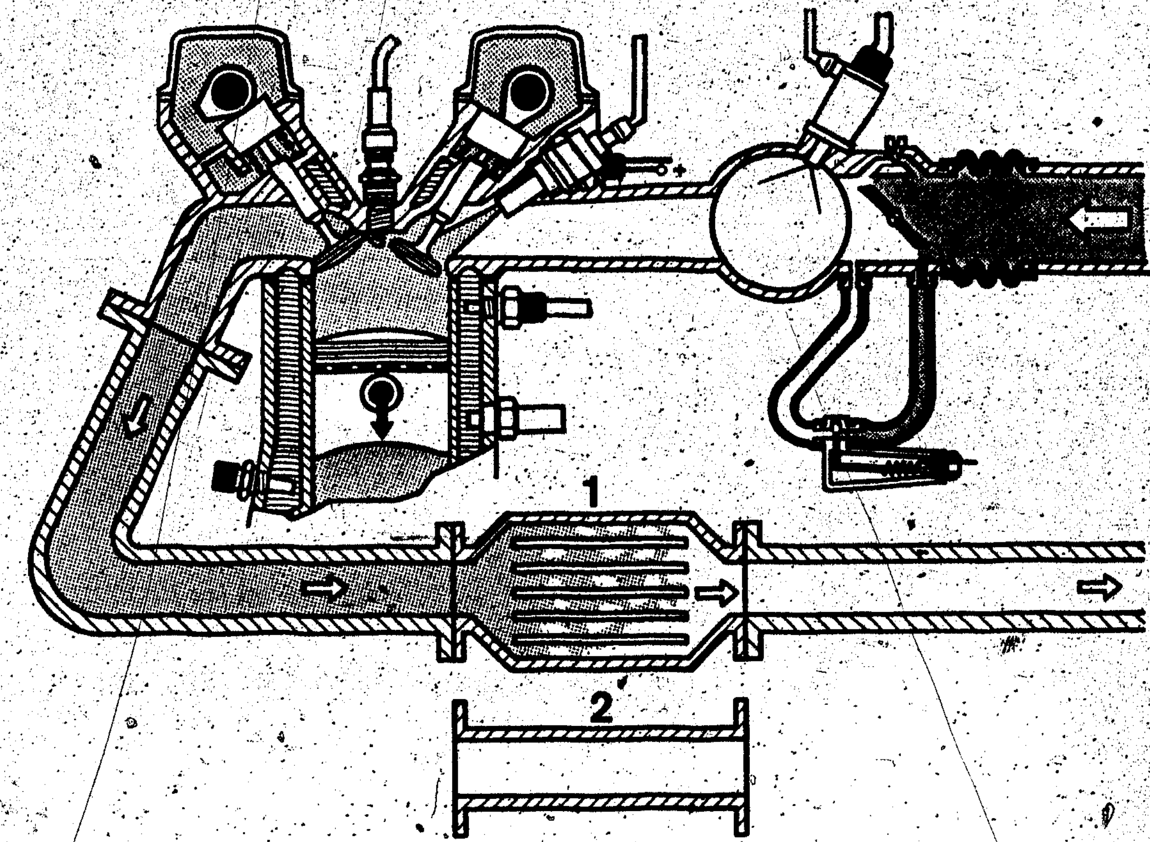

1 = Non-return valve
2 = Air filter
3 = Change-over valve
4 = Air pump

An air pump driven by the engine inducts fresh air through the air filter and forces it via a non-return valve into the exhaust ports. As in the case of secondary-air induction, there is a partial after-burning of the CO and HC residues. This makes the exhaust gas cleaner. A vacuum-controlled change-over valve controls the operation of the secondary-air injection system.

When testing or adjusting the idle speed and the CO concentration, shut down the secondary-air injection system. To do this, remove the hose from the outlet of the change-over valve (arrow) and seal off tight with a plug.

In countries without stringent exhaust emission legislation it is not necessary to shut down the secondary-air injection system.

## 4. Catalytic converter




1 = Catalytic converter    2 = Intermediate pipe

The single-bed catalyst installed in the exhaust system in export vehicles (also with lambda closed-loop control) reduces all three pollutants CO, HC and NOx to a minimum. The catalytic surface triggers chemical reactions of the pollutants, rendering them non-toxic.
Important: Proper operation only possible in conjunction with unleaded fuel (at present only in USA and Japan).

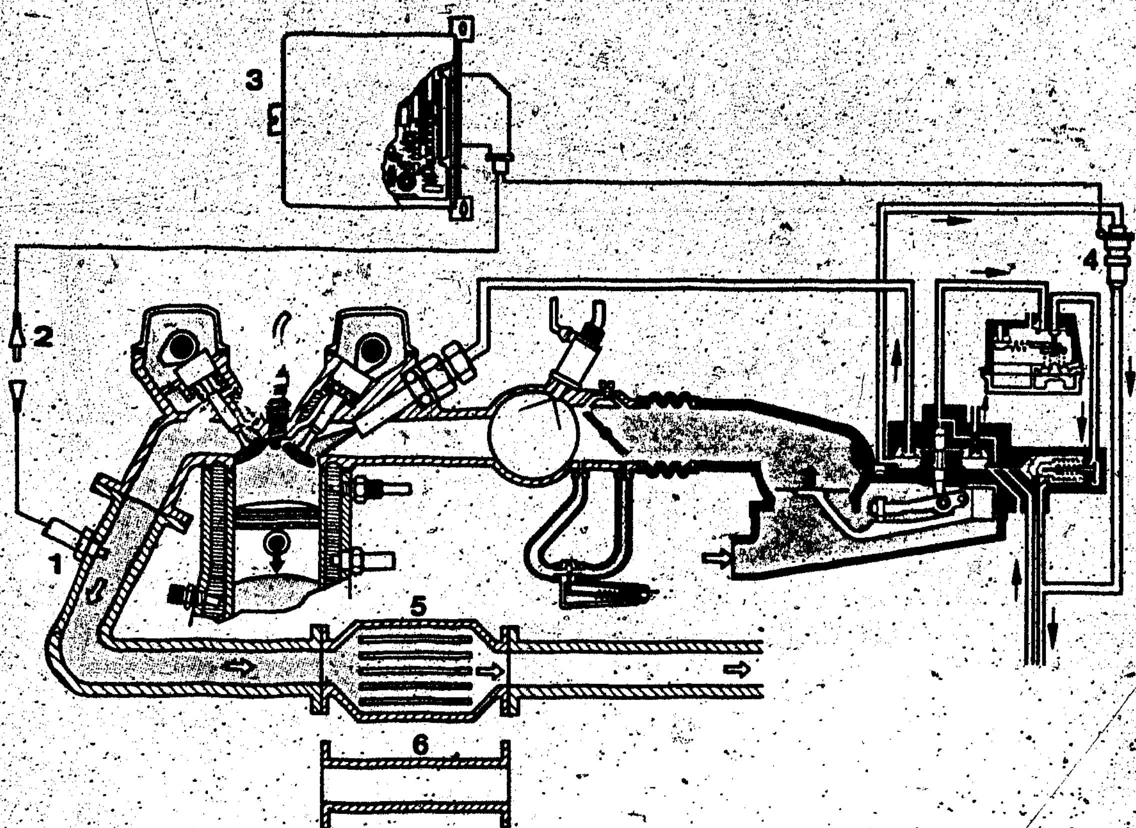
When testing or adjusting the idle speed and the CO concentration, the catalytic converter can be neglected since the exhaust-measuring point is upstream of the catalyst.

Caution!

If the vehicle is operated on leaded fuel (predominantly in countries without stringent exhaust emission legislation) the catalytic converter must be removed. If not removed, the catalytic converter would become clogged up and lead to a reduction in the power output of the engine.

Appropriate intermediate pipes for converting the exhaust system are available from the vehicle manufacturer.

## 5. Lambda closed-loop control




1 = Lambda sensor
2 = Plug
3 = Control unit
4 = Timing valve
5 = Catalytic converter
6 = Intermediate pipe

Export vehicles for the USA and Japan are equipped with lambda closed-loop control. This additional function of the K-Jetronic or L-Jetronic is not a downstream emission control system, but ensures a low pollutant content in the exhaust gas by means of optimum mixture preparation. Additional exhaust-gas recirculation, secondary-air induction or secondary-air injection is therefore not necessary in most cases. Like the catalytic converter, the lambda sensor (in the exhaust gas) operates only with unleaded fuel.
If the vehicle is operated on leaded fuel, the lambda sensor becomes clogged up and ceases to operate. The control unit detects this and switches from closed-loop to open-loop control. The system then operates on a fixed air-fuel ratio in the same manner as a K-Jetronic or L-Jetronic without lambda-closed-loop control. Before operating on leaded fuel, the lambda sensor should be removed and the installation hole should be closed off with a screw plug M18x1.5 (length of thread max. 8.5 mm). The disconnected plug (2) of the sensor connecting cable should be insulated and fastened to a suitable place on the vehicle body.

Caution!
Under no circumstances must the control unit or the timing valve be shut down on the lambda closed-loop control of the K-Jetronic.
The catalytic converter should be replaced by an intermediate pipe.

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After-Sales Service Department
for Training and Technology
(KH/VSK)

This information is available only in German. If necessary, please contact your regional representative.

Cette information n'est disponible qu'en allemand. Le cas échéant, veuillez vous adresser à votre représentation régionale.

Esta información está disponible únicamente en alemán. En caso necesario, sírvase dirigirse a su Representación Regional.

Questa informazione è disponibile solo in lingua tedesca. Se necessario, rivolgersi al proprio rappresentante di zona.

# HOT-STARTING PROBLEMS

VDT-I-Gen. 050 En

on vehicles fitted with Jetronic

9.1982

## Customer complaints

If the vehicle is parked and the engine switched off after having been run at normal operating temperature, it often occurs that the engine proves difficult to start, or won't start at all, and when it does start it runs extremely roughly (only on 2 or 3 cylinders). The engine has to be accelerated a number of times before it runs smoothly.

## Causes

For economic reasons ("stretching" of the mineral-oil reserves), it can happen that alcohol in varying quantities has been added to gasoline. Methanol is used for instance.
Such alcohol-added fuels, depending upon the amount of alcohol, adversely affect the hot-starting characteristics of the engine. The addition of alcohol raises the vapor pressure of the fuel and the result is that the boiling point of the alcohol-fuel mixture drops. This in turn leads to the formation of fuel-vapor locks in the fuel system when the engine has been switched off.

This means that when starting, and during the subsequent idle period, the air-fuel mixture is temporarily too lean.

## Remedies

- Check the ignition and Jetronic systems, particularly for leaks.
- Changing to another brand of gasoline can sometimes cure the problem immediately.
- In many cases, fully depressing the gas pedal helps during starting, as does slightly depressing the gas pedal during the idle period until the engine runs smoothly.
- Fit the pulse relay 0 340 000 003 (refer also to VDT-I-438/105) in vehicles with K and D-Jetronic.
  This step, though, will still not fully alleviate the rough running of the engine during the starting off phase

## Note:

The pulse relay 0 340 000 003 is NOT to be installed in vehicles fitted with L-Jetronic.

Please direct questions and comments concerning the contents to our authorized representative in your country.

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COLD-START, WARM-UP AND ACCELERATION PROBLEMS in Jetronic-equipped vehicles

VDT-I-Gen. 051 En
10.1984
(Supersedes Ed. 10. 82)

## Customer complaint

- Starting problems with cold engine
- Engine bucking during warm-up
- Rough idle (fluctuations in engine speed)
- Engine miss during acceleration (flat spot)
- Loss of power

## Cause

If the ignition and the Jetronic have been checked, and the test specifications are being reached, coking of the intake valves might be the cause of the problems sited.

Oil carbon, with its sponge effect, delays the continuous movement of the fuel from the fuel-injection valve to the combustion chamber.

As a result, the air-fuel mixture sometimes becomes so lean that it is no longer certain to ignite.

Motor Vehicle Service Information

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The loss in power is due to a reduction of the cylinder charge, and is the result of extremely serious coking.

Complex relationships between properties specific to the engine, the engine oil used, and fuels, as well as the driving cycles can produce such coking on the intake valves.

## Checking

If coking is suspected, we recommend checking the intake valves using an endoscope or a motoscope. Deposits on the valve head and/or shaft can be seen with these instruments and evaluated.

## Corrective measures

Take out the coked intake valves and remove the deposits mechanically.

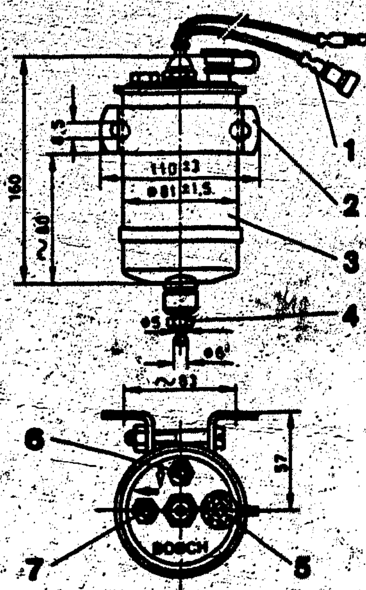
## Additives

There are no reliable results yet available on the effectiveness of cleaning additives or fuel additives. The use of fuel additives can cause deposits in the fuel system and damage certain plastics and seals.

Please direct questions and comments concerning the contents to our authorized representative in your country.

**WATER SEPARATOR 0 450 198 (108)** VDT-I-Gen. 063 En

for vehicles with gasoline injection 6.1985
K-, L-Jetronic and Motronic Supersedes Ed. 4.1984




1 = Electrical connecting leads
2 = Fastening clamp
3 = Water separator housing
4 = Water-drain fitting with drain plug - hex. AF 10 mm
5 = Vent screw with safety valve
6 = Inlet Hex. - AF 17 mm
7 = Outlet Female thread M 12 x 1.5

| | | |
|---|---|---|
| | Motor Vehicle Service Information | ➡ |

## Product

- Dimensions:
  approx. ø 90 x 160 mm
- Material:
  Stainless steel
- Design of upper side:
  Inlet and outlet with female thread M 12 x 1.5 - 10 mm deep. Vent screw with safety valve. 2 electrical connecting leads 300 mm long, 1 x pin terminal, 1 x blade receptacle ø 4 mm, for water-level indication.
- Design of lower side
  Water-drain plug - hex. AF 10 mm.
  Water-drain fitting ø 5/6 mm.
- Technical data:

| | |
|---|---|
| Operating pressure | ≤ 6 bar gauge pressure |
| Filter volume | = 600 $cm^3$ |
| Water storage volume | = 300 $cm^3$ |
| Pressure drop | = at 170 l/h < 0.1 bar |
| Temperature range | = - 30°C ... + 70°C |

- Electrical power:
  max. 6 W at 12 V
- Operation:
  Pressure-side water separation in gasoline fuels: Electrical switch output for water-level indication. Automatic blocking of discharge after water drainage completed.

Application:

- Use:
  In countries with problem fuel, i.e. with relatively high water content, it is advisable to retrofit a water separator.
  It is suitable for K-Jetronic, L-Jetronic and Motronic.
- Arrangement:
  The water separator is connected into the pressure line after the fuel filter.
- Advantages:
  The following components are protected against corrosion:
  K-Jetronic
  Fuel distributor, injection valves, start valve and warm-up regulator (in case of KE-Jetronic also the pressure regulator). In addition, electric fuel pump and accumulator through circulating fuel.

  L-Jetronic and Motronic
  Fuel-distribution pipe, pressure regulator, solenoid-operated injection valves and start valve.
  In addition, electric fuel pump through circulating fuel.
- Note:
  The water separator is not suitable for fuels containing alcohol (e.g. methanol).

Installation:

- Arrangement:

  In pressure line after fuel filter, e.g. in engine compartment.

- Position:

  As vertical as possible, max. inclination ± 5°.

- Mounting:

  With corresponding mounting clamp and two screws.

- Hydraulic connection:

  The previous hose line is cut into inlet line and outlet line. Both hose ends are to be equipped with 12 mm inlet unions and hose clamps and are to be connected to inlet and outlet of the end face with inlet-union screws M 12 x 1.5.
  Tightening torque 30 ... 35 Nm.
  Hold hexagon AF 17 mm with a wrench.

- Water drainage:

  If necessary, connect hose lines of inside width ø 5 mm to outlet fitting.

- Electrical connection:

  Connect indicator lamp (e.g. on instrument panel) or audible signal, max. 6 W at 12 V, through switch output. Use pin terminal and blade receptacle ø 4 mm.
  Cable cross section min. 0.75 mm².

Operation and maintenance:

If the indicator lamp lights up or if the audible signal sounds, the water separator must be drained as follows:

- Stop the engine, switch off the ignition.
- Hang water-drain hose in collector vessel.
- Open drain plug by 2 ... 3 turns using 10 mm open-end wrench.
  Water escapes until the water separator is relieved of pressure.
- Open vent valve as far as it will go with screwdriver.
  Water continues to escape.
- When no more water escapes or only slightly trickles, draining is completed.
  Water quantity max. approx. 300 cm³.
- Close drain plug again.
  Tightening torque 10 ... 12 Nm
- Close vent screw.
  Tightening torque 2 ... 3 Nm
- Start engine.
  Check whether the warning signal/indication has disappeared.
- Check for leaks at drain plug and vent screw.

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# Testing the injection valves

8.1979
Replaces Edition of 6.1979

## 1. Test method

The dynamic flow quantity of each injection valve is measured and compared to that of a new injection valve of comparable size. The test is carried out with the engine switched off. Due to the direct comparison of the measurement data, as opposed to absolute measurement, the tolerances in pressure, temperature, fuel viscosity and battery voltage are no longer of importance because the new injection valve (comparison valve) is tested under exactly the same conditions.

## 2. Test equipment and tools:

| | | |
|---|---|---|
| 1 Tester (for D-Jetronic veh's) | 0 681 500 000 | EFAW-228 |
| or | 0 681 500 008 | 228 a |
| 1 Pressure gauge (up to 6 bar) | 1 687 231 153 | |
| 1 Measuring glass 600 ml e.g. (scale from 360 - 600 ml, divisions of 1 ml) | 1 688 439 517 | |

1 2-conductor cable with plugs (approx. 1500 mm long)

1 Fuel hose (approx. 1500 mm long, ID 8 mm)

1 Hose nipple (approx. 30 mm long, dia. 8 mm)

2 Hose straps (to fit the above)

1 Stopwatch or clock with easily readable seconds display

1 New (Comparison) valve — Injection valve with the same static injected-fuel quantity as the valves under test (see the Table in the appropriate Testing and Repair Instructions VDT-W-280/.., the comparison valve does not necessarily have to have the same Part Number)

Take care when using fuels, do not cause sparks, danger of fire and explosion!

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## 3. Test procedure

### 3.1 Preparations for the test

The D-Jetronic installation must be tested, and repaired if necessary, in compliance with Testing and Repair Instructions VDT-W-280/.. .

Control unit and fuel pressure must be OK.

Remove the injection valve to be tested from the intake manifold and connect it to the extension fuel hose.

Connect the Tester between the control unit and the wiring harness.

Set up themeasuring glass at a safe place on the engine and secure it.

### 3.2 Testing the injection valve

On the Tester, turn the switch "A" to the "Valve test" position, switch "B" has no effect.

Press the "Pump" button, when the pressure has reached a constant value press the valve button for the comparison valve and, using the stopwatch or clock, measure the test time.

(Tolerance values referred to the comparison valve are to be found in the Table in the appropriate Testing and Repair Instructions VDT-W-280..)

4. The remaining details and data are contained in the Supplements to the Testing and Repair Instructions for vehicles with D-Jetronic VDT-W-280/.. .

# New Product

VDT-I-438/4 En

1.1983

OVERRUN FUEL CUT-OFF

Retrofit kits for K-Jetronic engines

## 1. General

In order to counteract the rising fuel prices, there are a number of possibilities on the market for reducing fuel consumption.
One of the measures which can be taken is to lower fuel consumption by means of the so-called overrun fuel cut-off. This is a system which cuts-off the supply of fuel to the engine completely when the vehicle is in the overrun mode. That is, when the vehicle has sufficient momentum for it to keep on moving without the engine actually supplying any driving power.

Advantages:

- Depending upon driving habits and upon the actual layout of the system concerned, fuel savings are about 5%. In town driving, with its frequent changes of load, the savings are more pronounced than, for instance, on the motorway. The carbon monoxide (CO) and hydrocarbon (HC) emissions in the exhaust gas are reduced.

  During the overrun phase, the engine-braking effect is slightly increased. This is an advantage when driving downhill.

Due to the increased engine-braking effect though, the driving comfort of vehicles with manually shifted transmissions is adversely affected to a slight degree. This is only noticeable upon extreme changes of load which take place, for example, when the vehicle is sharply accelerated out of the overrun mode.

A number of car manufacturers are already fitting the overrun fuel cut-off as standard to K-Jetronic engines.
In addition, Bosch also has this facility available in the form of a retrofit kit suited for installation in a number of different vehicle models.
The overrun fuel cut-off is assembled with all fastening parts and the appropriate installation instructions in retrofit kits specifically matched to the vehicle in question.
In the Federal Republic of Germany, these retrofit kits have been cleared by the respective authorities and awarded homologation. This means that in Germany, the vehicle papers do not have to be modified nor does the vehicle have to be presented to the technical inspection authorities for examination after one of these kits has been fitted.
Please check the relevant regulations in your country.

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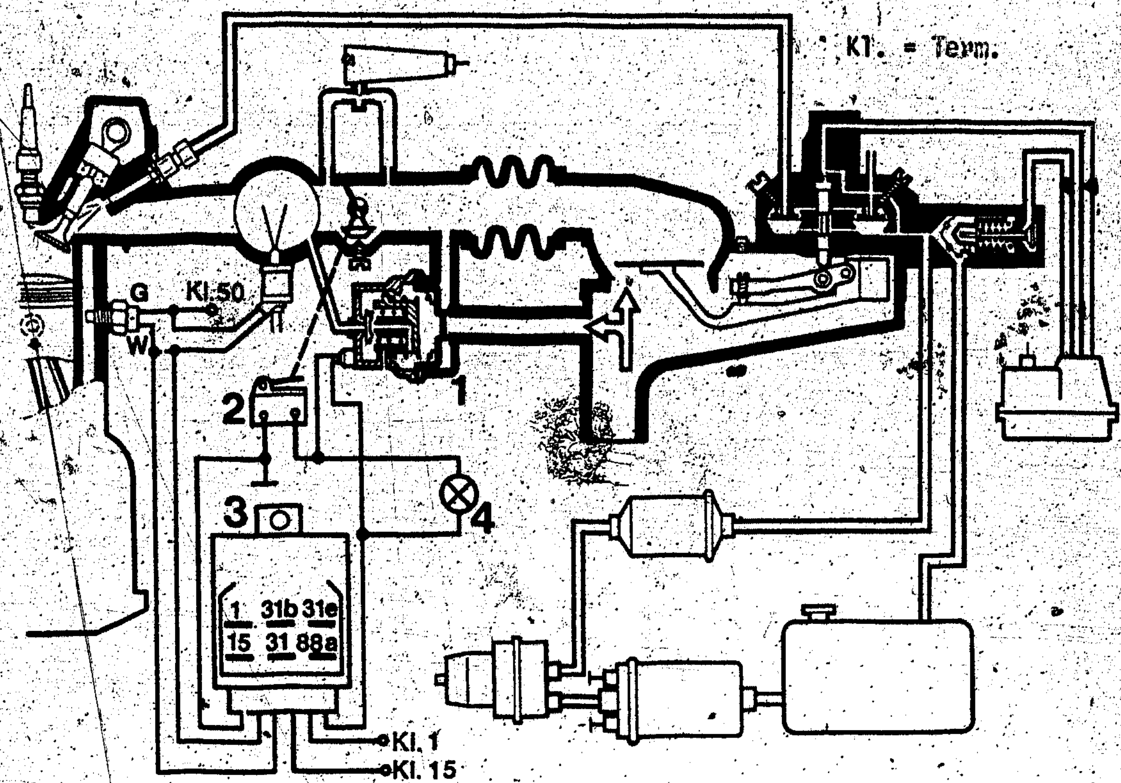
## 2. Design, function and method of operation




### 2.1 Design, new components

1 = Overrun cut-off valve (in the air bypass to the sensor plate)
2 = Microswitch (at the throttle-valve assembly, for idle recognition)
3 = Engine-speed relay (with cut-in and cut-out speed thresholds, and suppression of overrun cut-off facility during the warm-up phase).
4 = Indicator lamp (lights up when the overrun cut-off valve is energized).

### 2.2 Function and method of operation

#### Engine-speed relay

- Continuously registers the engine-speed pulses at Term. 1 of the ignition coil

- Continuously compares the measured engine speed with engine-specific cut-in and cut-out engine-speed thresholds above the idle speed. These cut-in and cut-out speeds are permanently stored in the speed relay.

- Depending upon the engine speed, the relay applies positive battery voltage to the overrun cut-off valve.

- The relay is provided with the temperature-dependent ground signal from Term. W of the thermo-time switch, in order to suppress the overrun cut-off during the warm-up phase.

## Microswitch

This switch identifies the throttle-valve open and throttle-valve idle modes.

It connects the overrun cut-off valve to ground in the throttle-valve idle mode, i.e. dependent upon load.

## Overrun cut-off valve

When the engine has reached normal operating temperature, and depending upon engine speed, the cut-off valve is connected to battery voltage (plus) by the engine-speed relay.

When the throttle valve is in the idle position, the cut-off valve is grounded by the microswitch (load-dependent).

If both battery voltage (plus) and ground (negative) are connected, the control valve in the cut-off valve opens electromagnetically.

The vacuum prevailing in the intake manifold becomes effective at the spring-loaded diaphragm and opens the bypass channel.

## Fuel cut-off

In the overrun mode and with the overrun cut-off valve open, the intake air drawn in by the engine bypasses the air-flow sensor.

The sensor plate therefore remains in its neutral (undeflected) position and the result is that no fuel is injected. In this operating mode, the engine no longer receives an air-fuel mixture but merely air. This means that combustion ceases, the engine delivers no power and fuel consumption is zero.

## Resumption of fuel-injection

Fuel-injection is resumed again as soon as the accelerator pedal is depressed. The movement of the accelerator pedal away from the idle position is identified by microswitch.

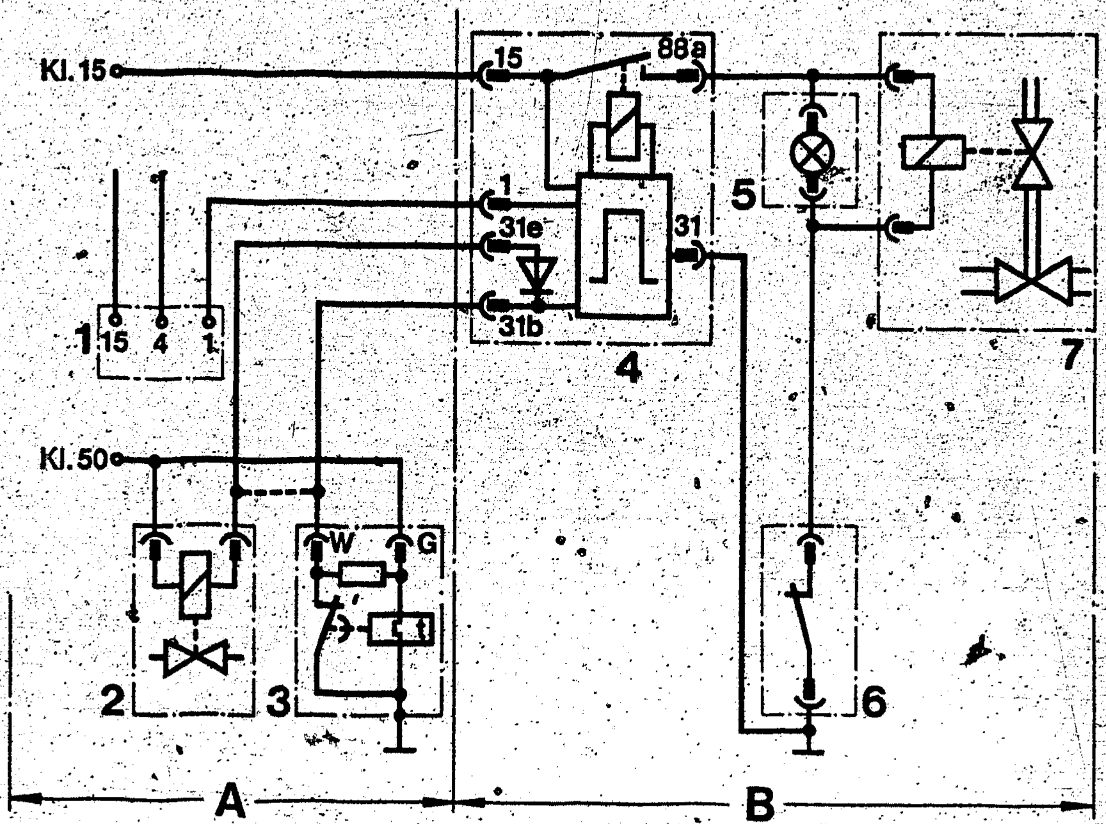
Fuel injection is resumed again when the engine speed drops below the cut-out threshold. Identified by the engine-speed relay.

If voltage supply (plus) or the connection to ground (negative) is interrupted, the control valve in the overrun cut-off valve closes due to spring force.

The spring-loaded diaphragm closes the air bypass channel and normal fuel-injection is resumed again in full.

A21

3. Electrical wiring diagram




Kl. = Term.

A = Components in the ignition and fuel-injection systems

1 = Ignition coil
2 = Start valve
3 = Thermo-time switch

B = Components for the overrun fuel cut-off

4 = Engine-speed relay
5 = Indicator lamp
6 = Microswitch
7 = Overrun cut-off valve

NEW TOOL — VDT-I-438/1000 En

Pulse generator KDJE-P 700 — 12.1983

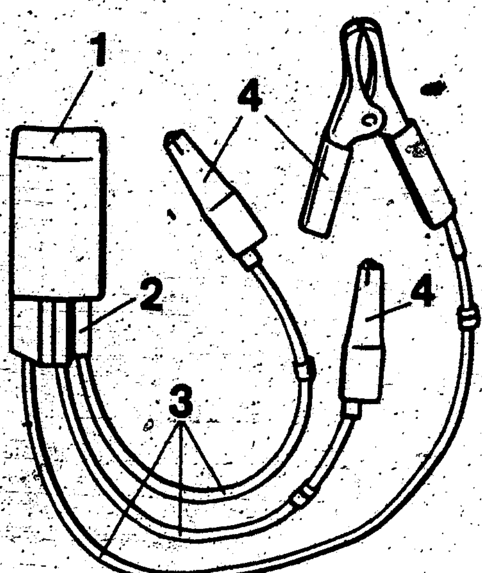
For test work on vehicles with K-Jetronic

The K-Jetronic system in the vehicle is usually tested with the engine stationary. In order to supply the components electric fuel pump, warm-up regulator and auxiliary-air device with voltage, the safety circuit must be bridged.
To do this it is customary to disconnect the electronic relay: the contacts 30 and 87, (87b) in the plug base being connected with a fuse between them.

If access to the electronic relay is difficult, e.g. if it is fitted under the instrument panel, bridging can be carried out best of all with a pulse generator.

## Design

The pulse generator consists of an impulse relay with integrated printed-circuit board relay, plug base and 3 connecting cables with clips.




1 = Impulse relay
2 = Plug base
3 = Connecting cables
4 = Clip

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## Function

When the inductivity of the printed-circuit board relay is switched off, voltage impulses of approx. 300 $V_{ss}$ at a frequency of approx. 1.5 Hz are formed. Terminal 31b, (1, TD) of the electronic relay in the safety circuit is then supplied with these impulses.

## Connections

Disconnect the multiple plug from the trigger box with electronic ignition systems. Disconnect all cables from terminal 1 of the ignition coil.

- Connect the green clip to the cable of terminal 31b, (1, TD) on the electronic relay.
- Connect the yellow clip to ignition coil terminal 15 (+).
- Connect the black clip to vehicle ground (-).

When the ignition is switched on, the components electric fuel pump, warm-up regulator and auxiliary air-device are supplied with battery voltage via the electronic relay. This procedure is triggered off by the pulse generator.

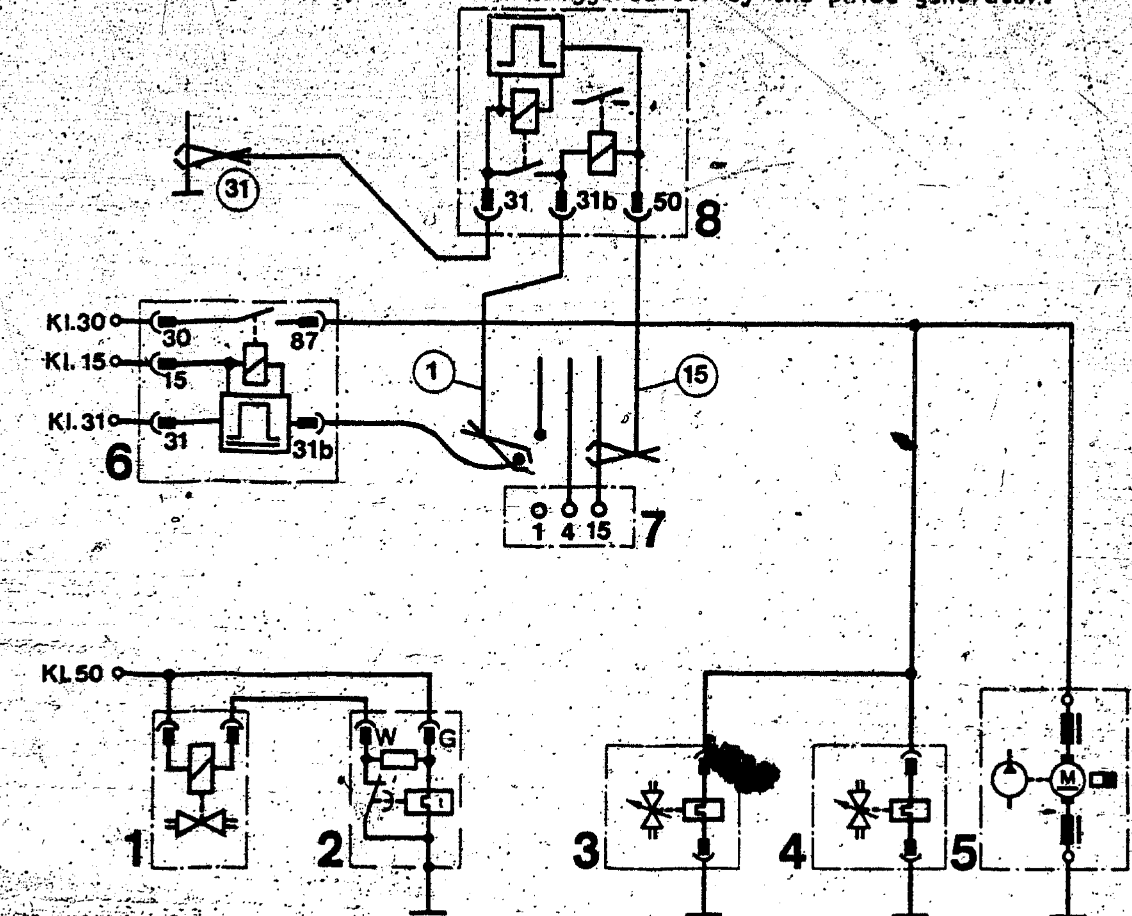


Diagram of safety circuit with electronic relay

1 = Sart valve
2 = Thermo-time switch
3 = Warm-up regulator
4 = Auxiliary-air device
5 = Electric fuel pump
6 = Electronic relay
7 = Ignition coil
8 = Pulse generator

1 = green
15 = yellow
31 = black

Kl. = terminal

**Remarks**

Pulse generator KDJE-P 700 replaces the former control relay KDJE 7458. As a result of its simple construction, the control relay had a high pulse frequency.
It could only be used on vehicles without a tachometer and without rotational-speed limitation by means of switching off the pump.

# Packaging of goods under warranty



K-Jetronic (CIS)

VDT-I-438/101 B
10.1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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438

EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254

VDT-I-438/104 En
9.1984
(Replaces Ed. 3.1983)

| Electric fuel pump | Parts set (non-return valve + seal ring) | Non-return valve | Seal |
|---|---|---|---|
| 0 580 254 001 | 1 587 010 500 | --- | --- |
| 003 | 502 | --- | --- |
| 005 | 502 | --- | --- |
| 007 | 500 | --- | --- |
| 008 | 508 | --- | --- |
| 010 | 508 | --- | --- |
| 011 | 002 | --- | --- |
| 941 | 002 | --- | --- |
| 942 | 002 | --- | --- |
| 945 | 006 | --- | --- |
| 947 | 002 | --- | --- |
| 948 | 005 | --- | --- |
| 949 | 002 | --- | --- |
| 950 | 006 | --- | --- |
| 952 | 002 | --- | --- |
| 953 | [illegible] | --- | --- |
| 954 | 002 | --- | --- |
| 956 | 002 | --- | --- |
| 957 | 002 | --- | --- |
| 959 | 002 | --- | --- |
| 960 | 002 | --- | --- |
| 961 | 002 | --- | --- |
| 963 | 005 | --- | --- |
| 964 | 002 | --- | --- |
| 965 | 002 | --- | --- |
| 967 | 002 | --- | --- |
| 968 | 002 | --- | --- |
| 970 | 002 | --- | --- |
| 972 | 002 | --- | --- |

Technical Bulletin

BOSCH Geschäftsbereich KH, Kundendienst Kraftfahrzeug-Ausrüstung.


A27

| Electric fuel pump | Parts set (non-ret. valve and seal ring) | Non-return valve | Seal |
|---|---|---|---|
| 0 580 254 973 | 1 587 010 002 | | |
| 975 | 003[4] | | |
| 976 | 004[3] | | |
| 978 | 1 587 410 901 | | |
| 979 | 010 004[3] | | |
| 980 | 002 | | |
| 982[1] | 003[4] | | |
| 982[2] | 1 587 410 901 | | |
| 984 | 010 004[3] | | |
| 985 | --- | 1 583 385 006 | 1 580 203 002 |
| 986 | --- | 386 011 | 001 |
| 987 | --- | 008 | 001 |
| 988 | --- | 008 | 001 |
| 989 | --- | 008 | 001 |
| 990 | --- | 385 004 | 002 |
| 991 | --- | 004 | 002 |
| 992 | 1 587 010 001 | --- | --- |
| 996 | | 386 001 | 001 |
| 998 | | 385 004 | 002 |
| 9 580 233 014 | 508 | --- | --- |
| 234 003 | 002 | --- | --- |
| 005 | 002 | --- | --- |

[1] = up to FD 822 [2] = as from FD 823

[3] = parts set ..003 can also be used (delivery-line connection at 90°)

[4] = parts set ..004 can also be used (delivery-line connection axial)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Technical Bulletin

A28

A28 26 24

VDT-I-438/105 En
3.1980

K-Jetronic

Replaces Ed. 2.1980

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5..

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

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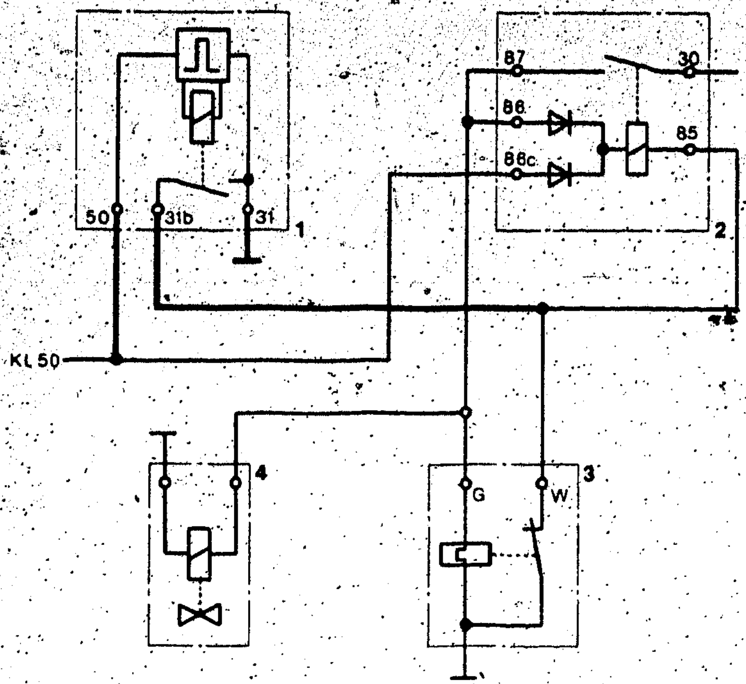
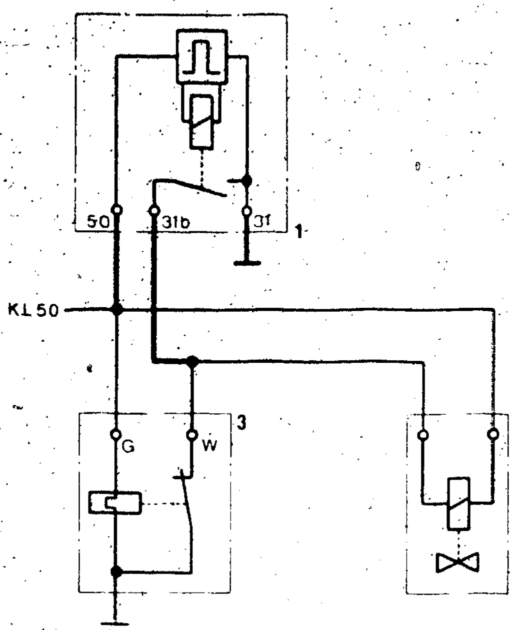
B1




K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve




K-Jetronic system without post-injection relay

ELECTRIC FUEL PUMPS
FOR K-JETRONIC 0 580 264 ..

VDT-I-438/110 En
7.1985

Cross-Reference List of Replacement Models

Several electric fuel pumps for K-Jetronic can be replaced by preferred models by after-sales service workshops.

Various parts sets with different non-return valves are additionally required.

These parts sets must be ordered separately.

| Preferred model | with additional parts set | can replace |
|---|---|---|
| 0 580 254 992 | 1 587 010 513 | 0 580 254 998 |
| | | .. 996 |
| | | .. 991 |
| | | .. 985 |
| 0 580 254 967 | 1 587 010 512 | .. 984 |
| | | .. 982 |
| | | .. 978 * |
| | | .. 976 |
| | | .. 964 |
| 0 580 254 957 | 1 587 010 501 | .. 961 |
| | | .. 953 * |

Technical Bulletin




B3

| Preferred model | with additional parts set | can replace* |
|---|---|---|
| 0 580 254 975 | 1 587 010 512 | 0 580 254 947 |
| 0 580 254 003 | 1 587 010 500 | .. 001 |

* Electrical connections for blade receptacle 6.3 mm.

Further information on microcard KE - 26

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

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HOT-STARTING PROBLEMS VDT-1-Gen. 056 En

VEHICLES WITH K-JETRONIC 2.1983

This Service Information contains special suggestions on how to remedy hot-starting problems concerning the general information contained in Service Information VDT-I-Gen. 050 of 9.1982

Customer complaint (Symptom of trouble)

- After the vehicle has been standing for a short while the engine which is still hot has difficulty starting again.
- After hot-starting the engine runs rough (e.g. only on 2 or 3 cylinders).

Causes

- Formation of vapor bubbles in the hot fuel, particularly in the injection valves and injection lines, due to hydraulic leaks.
- Formation of vapor bubbles despite the absence of hydraulic leaks as a result of using a poor grade of fuel.

Owing to a high percentage (approx. 8%) of volatile alcohols (e.g. methanol) in the fuel its vapor pressure is higher than normal.
The consequences are:
- Formation of vapor bubbles
- Chattering and poor spray formation of the injection valves.
- Lean mixture composition in some cylinders due to a shortage of fuel.

Tests

Before testing, make sure that he ignition system and valve timing are O.K.

Checking the K-Jetronic system

Pay particular attention to the following sources of trouble:

- Hydraulic leaks in the fuel system with the engine hot.
  The vehicle-specific minimum pressures 10 and 20 minutes after stopping the engine must be observed.
- Leaks on injection valves
  No formation of drops within 15 seconds
- Zero-position of air-flow sensor plate.
  Top edge of air-flow sensor plate must be flush with the start of the conical section of the funnel.

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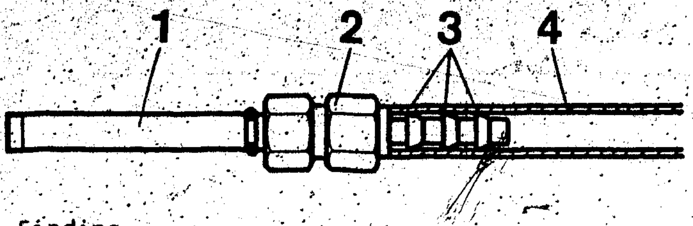
B5

• Sealing edges (so-called "fishbone section") of the connecting parts must be securely seated in the polyamide injection line.
The fit may have become loose due to frequent changes of temperature.
If necessary, replace injection lines.




1 = Injection valve
2 = Connecting part
3 = Sealing edges
4 = Injection line

Finding

If the K-Jetronic system has been checked and if all the measured data are within the test-specification tolerance, then the grade of fuel can be taken as the cause of the trouble.

Corrective action

It may be sufficient to change the brand of fuel.

After-sales service solutions

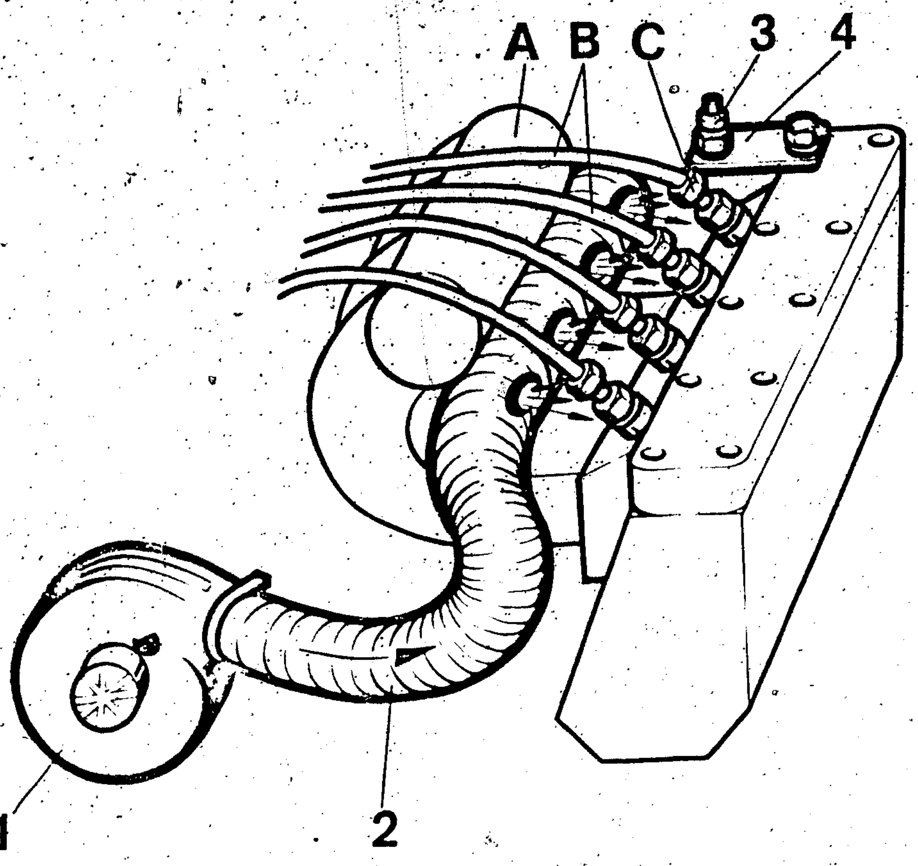
Recommendation for acceptable starting performance (shorter than 5 seconds):
Installation of time-pulse relay 0 340 000 003 as described in Technical Bulletin VDT-I/438/105 (3.1980).
Due to the time-pulse relay the start valve is energized intermittently during hot-starting. Additional fuel is injected through the start valve and this compensates for the shortage of fuel from the injection lines caused by vapor bubbles.
However, smooth running of the engine after starting is only obtained by forcing the vapor bubbles out of the injection lines (by wide opening of the throttle).

Recommendation for good starting performance and smooth engine running:
Installation of injection valve cooling by means of additional fan and thermo-switch. The formation of vapor bubbles is (largely) prevented by this after-sales service measure.

## Injection valve cooling

### Necessary components and parts

- Centrifugal fan — e.g. 0 130 007 801 12 V/6A 4000 $min^{-1}$
  or VWW 035 959 175A. possibly with further connecting parts.
- Thermo-switch — VWW 035 959 481B On: 100°C, Off: 94°C
- Air guide hose — Aluminium or polyamide hose, 70 mm or 50 mm dia., flexible, oil-and fuel-resistant, heat-resistant up to + 120°C (commercially available, e.g. Westaflex, 4830 Gütersloh, Zum stillen Frieden 22).
- Hose clamps
- Brackets for fan and thermo-switch (user-fabricated)
- Relay, fuse holder with 8 A fuse, plug.




**New components**

1 = Centrifugal fan
2 = Air-guide hose
3 = Thermo-switch
4 = Holding plate

**Parts of the engine**

A = intake manifold
B = injection lines
C = injection valve

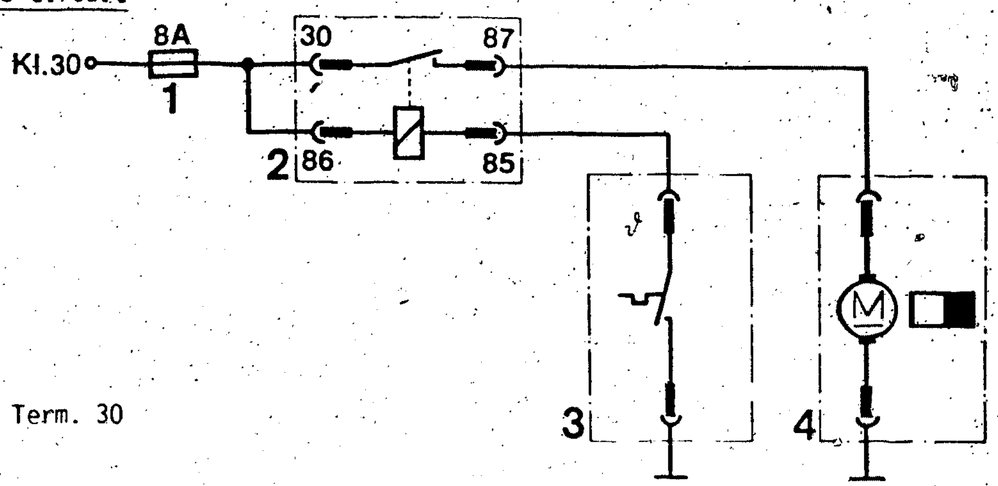
## Layout

- The fan should be installed so that clean air is drawn in from a point which is as cool as possible. Protect the intake side from dirt.
  Example: A low position in the engine compartment behind the radiator grille or near the left-hand or right-hand side-wall.

- The air-guide hose is laid free of tension from the fan to the intake manifold, along the injection valves.
  Seal off the end of the hose and make openings at the side toward the injection valves, the openings having a diameter of approx. 25 mm.
  Fix the air-guide hose in position with hose clamps and bracket so that engine vibrations are absorbed by the flexible air-guide hose.

- Install the thermo-switch near the worst cooled injection valve (usually on the last cylinder). The place of installation should be selected such that the thermo-switch has, if possible, the same temperature as the injection valve. This applies both to the heat from the engine as well as to the cooling from the auxiliary fan. However, the flow of air from the fan must not be aimed directly at the thermo-switch (otherwise the on-time of the fan is too short).
  Example: By means of a holding plate the thermo-switch can be mounted on the valve cover or cylinder head by means of an existing screw.

## Electric circuit




Kl.30 = Term. 30

1 = Fuse holder with 8 A fuse
2 = Relay with plug-in base
3 = Thermo-switch
4 = Fan

Make electric installation in accordance with the circuit diagram. Pay attention to ground connection and thermal contact of thermo-switch.

# New Product

VDT-I-438/3 En
10.1982

KE-JETRONIC

Electronically controlled continuous injection

Today, the car user and the lawmaker are increasing their demands for engines with better MPG figures and lower toxic content of the exhaust gas.

This means that Bosch, as manufacturer of gasoline injection systems, is forced into continuous further development and optimization of its existing systems. Furthermore, it is also compelled to develop new technical ideas in the sector of fuel management.

The new KE-Jetronic is a further development of the familiar K-Jetronic and will appear on the market for the first time in Autumn 1982 and will be fitted on 4-cylinder engines. It is intended that in future both systems will remain in service side by side.

Apart from a few detail modifications, the hydraulic-mechanical basic principles of the K-Jetronic have been used almost without exception for the KE-Jetronic. The most important difference between the two systems lies in the fact that for the KE-Jetronic, all the auxiliary functions (correction and adaptation) required for everyday operation are controlled by electronic circuitry. This means that the separate control-pressure circuit with control-pressure regulator (warm-up regulator) as used in the K-Jetronic is no longer necessary. The pressure acting upon the control plunger is constant and identical to the primary pressure.

All auxiliary functions are controlled by an electromagnetic pressure-correcting element which continuously influences the lower-chamber pressure of the differential pressure valves in the fuel distributor. Depending upon the operating point of the pressure-correcting element, variation of the differential pressure results in either enrichment or leaning-off of the air-fuel mixture. Due to the hydraulic linking of all lower chambers, the change in air-fuel mixture is the same for all cylinders.

The pressure-correcting element is driven by a variable electric current from an electronic control unit (ECU) in which such information as engine temperature, engine load, throttle-valve position, starting-motor operation, atmospheric pressure and changes resulting from accelerator-pedal movement etc. is processed.

The design of the pressure-correcting element is such that even if the electrical supply is open-circuited, the warm engine will still run (limp-home characteristic). Correction functions are then impossible.

In the case of vehicles with Lambda control, intervention for control purposes also takes place through the pressure-correcting element. The result is that it is no longer necessary to have the extra hydraulic components and changes in the hydraulic circuitry required by the K-Jetronic when a non-basic version is needed.

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The remaining components of the KE-Jetronic, such as electric fuel pump, fuel accumulator, start valve, fuel-injection valves, thermo-time switch and auxiliary air device, correspond to those fitted to the K-Jetronic.

In Fig. 1, peripheral sensors are shown together with the functional scope of the K-Jetronic which is controlled by the ECU through the pressure-correcting element.

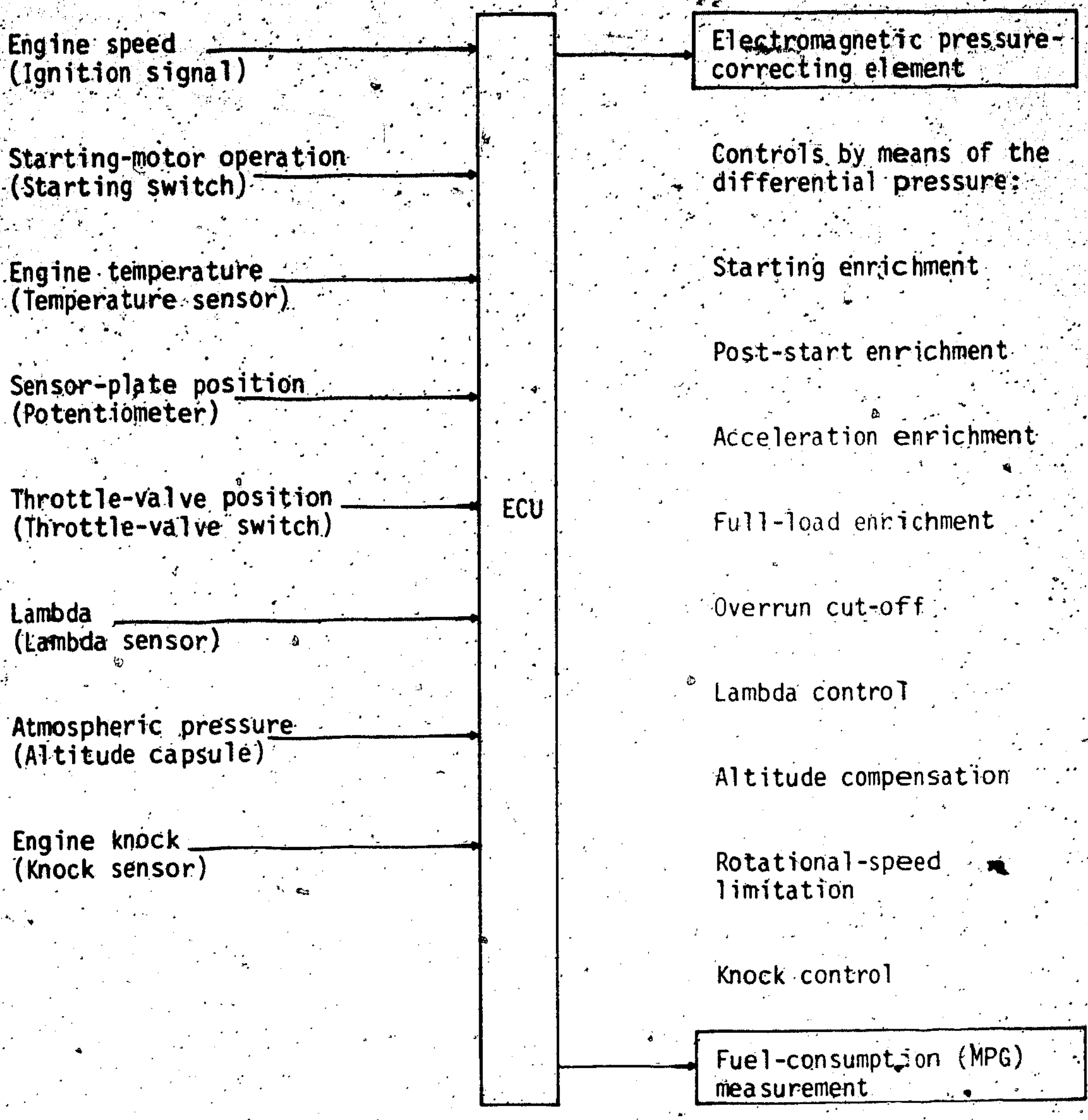
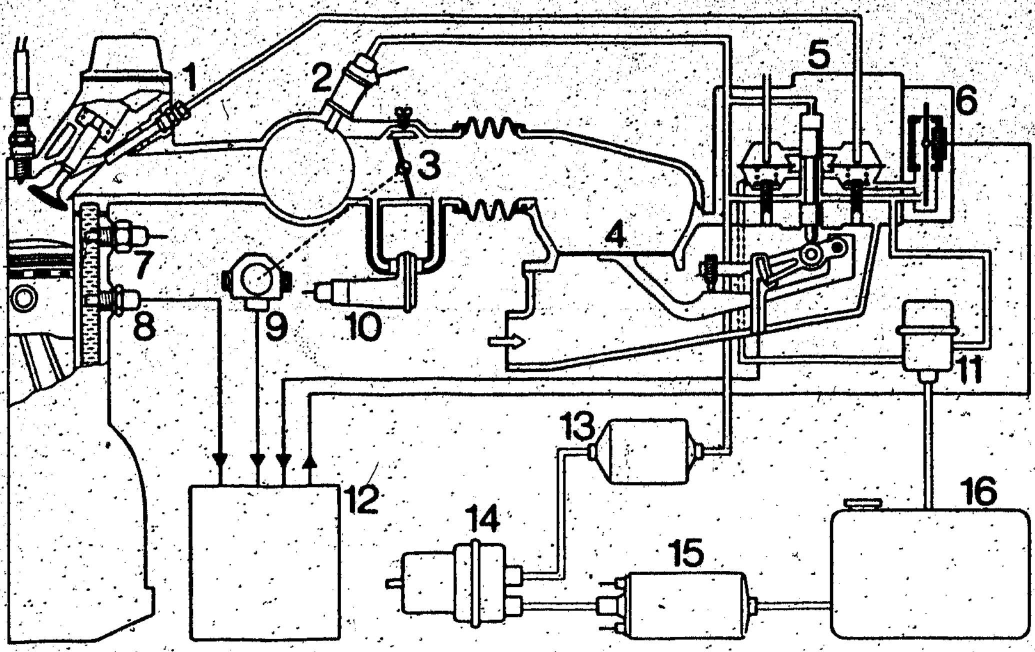


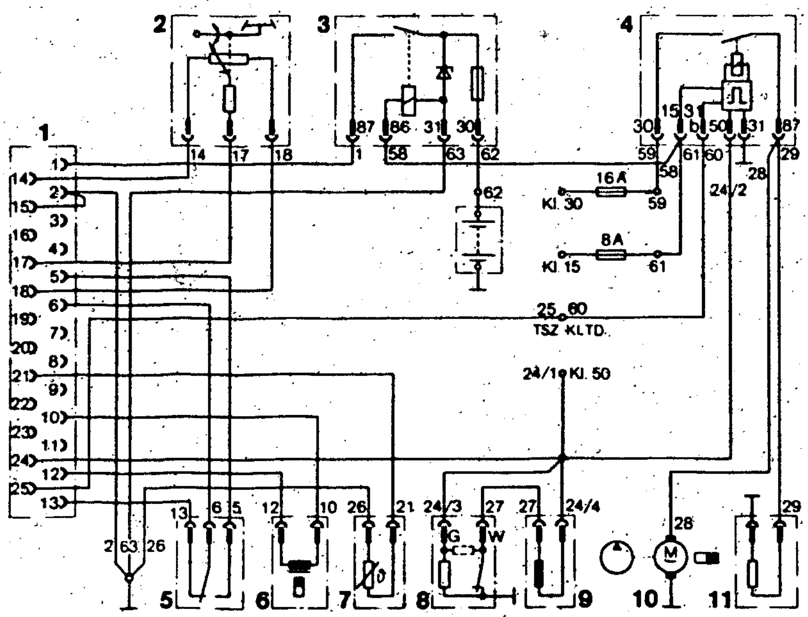

Fig. 1

Fig. 2 KE-Jetronic, overall system




1 = Fuel-injection valve
2 = Start valve
3 = Throttle valve
4 = Air flow sensor
5 = Fuel distributor
6 = Pressure-correcting element
7 = Thermo-time switch
8 = Temperature sensor
9 = Throttle-valve switch
10 = Auxiliary air device
11 = Diaphragm-type pressure regulator
12 = ECU
13 = Fuel filter
14 = Fuel accumulator
15 = Electric fuel pump
16 = Fuel tank

Fig. 3 Electric circuit diagram of the KE-Jetronic




TSZ = TCI
Kl. = Term.
1 = ECU
2 = Air-flow sensor potentiometer
3 = Electronic relay with over-voltage protection
4 = Speed relay
5 = Throttle-valve switch
6 = Pressure-correcting element
7 = Temperature sensor (NTC resistor)
8 = Thermo-time switch
9 = Start valve
10 = Electric fuel pump
11 = Auxiliary air device



3/1 A3 A15

## Description of the components:

### Electronic control unit (ECU):

The ECU is provided with a 25-pole plug connection and processes all the signals from the peripheral sensors. It transmits a current signal of appropriate magnitude to the electromagnetic pressure-correcting element. The overall current range is from 0 mA (in the normal operating mode with the engine warm) to approx. 120 mA (max. enrichment, enrichment factor approx. 2.5).

For certain functions (overrun cut-off, engine-speed limitation), current reversal takes place to about - 40 mA. Due to the pressure-correcting element/fuel-distributor function, this interrupts the fuel injection.

### Fuel distributor:

The fuel distributor of the KE-Jetronic differs in the following details from the one in the K-Jetronic:

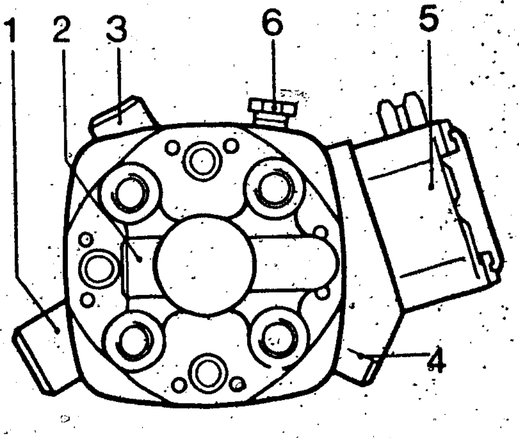
The primary-pressure regulator is not integrated in the fuel distributor. Its function is taken over by an external diaphragm-type pressure regulator.

The adjusting screws and valve springs of the differential-pressure valves are located in the lower chambers of the fuel distributor, and the upper chambers are equipped with a support spring for the ceramic plate of the diaphragm. In addition, a fine-mesh flat strainer is fitted in the upper chambers between the inlet and the valve seat. This traps even the smallest particles of dirt and prevents them from reaching the valve seat. The upper chamber volume has been decreased in comparison with the K-Jetronic.

The sheet-metal casing with damping restriction above the control plunger is firmly flanged to the metering-slot barrel.
A spring is fitted above the control plunger. This feature has already been introduced in part on the K-Jetronic.

Fig. 4 Fuel distributor with electromagnetic pressure-correcting element

1 = Fuel return
2 = Connection for start valve
3 = Pressureless return
4 = Fuel inlet
5 = Pressure-correcting element
6 = Connection for the pressure measurement (Bosch Service Station test; this bore is closed during operation).



A new form of control plunger sealing from below has also been adopted. Whereas, with the K-Jetronic, the zero position of the control plunger was determined by its contacting the main lever of the air-flow sensor, in the KE-Jetronic the control plunger comes up against a shaped seal ring in the zero position. This seal ring is secured by an adjusting screw and can be varied in height to achieve the most favorable coverage of the metering slits. When the engine has been switched off, the control plunger is forced down onto the seal ring by the pressure of the spring and by the residual primary pressure. This measure, in connection with the external sealing-off of the leak-fuel bore when the engine is switched off, prevents pressure loss due to leakage at the pressure guide (this means that pressure retention in the injection system is improved).
The pressure-correcting element is directly flanged onto the lower half of the fuel-distributor housing. The hydraulic connection between both components is by way of the overlapping bores which are sealed off from each other, and to the outside, by O-rings.

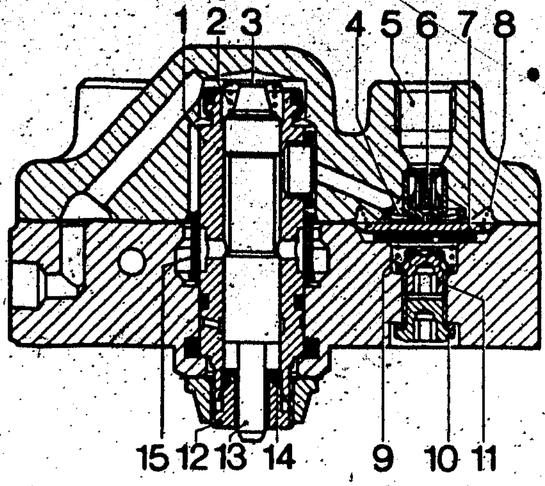



Fig. 5 - Fuel distributor

1 = Barrel with metering slits
2 = Plunger spring
3 = Sheet-metal cap with damping restriction
4 = Flat strainer
5 = Fuel-injection line connection
6 = Outlet strainer
7 = Diaphragm with ceramic plate
8 = Support spring
9 = Differential-pressure valve spring
10 = Closure plug
11 = Adjusting screw
12 = Adjusting screw
13 = Control plunger
14 = Shaped seal ring
15 = "Basket"-type strainer

Diaphragm-type pressure regulator:

The diaphragm-type pressure regulator fulfills three tasks:

- Control of the primary pressure.
- When the engine is switched-off, the pressure must be reduced as rapidly as possible to below the injection-valve opening pressure in order that the valves leave the "chattering" state and seal-off efficiently.
- When the engine is switched-off, the system return lines (return line from the differential-pressure valve lower chambers, leakage-fuel line from the fuel distributor) have to be closed (this corresponds to the function of the push-up valve in the K-Jetronic).

Fig. 6 Diaphragm-type pressure regulator

1 = Fuel inlet

2 = Diaphragm

3 = Control spring

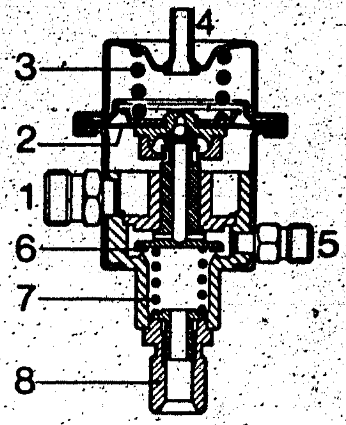
4 = Vent

5 = Return, differential-pressure valves

6 = Sealing plate

7 = Control spring for residual primary pressure

8 = Fuel return




Electromagnetic pressure-correcting element:

Depending upon the current signal coming from the ECU, the pressure-correcting element controls the differential pressure at the metering slits in the fuel distributor.

A reduction in the differential pressure results in a reduction of the quantity of fuel injected (mixture lean-off), and vice versa.

The pressure-correcting element is connected into the fuel distributor between the primary-pressure circuit and the lower-chamber inlet to the differential-pressure valves. A fixed restriction with a constant through-flow is fitted in the return from the lower chambers to the collective return.

The pressure drop at the pressure-correcting element is variable depending upon the pressure-correcting element current, and results in a variable lower-chamber pressure. This, on the other hand, leads to a change in the difference between the pressures in the lower and upper chambers which, in turn, causes a correction of the injected fuel quantity.

Fig. 7 Electromagnetic pressure-correcting element

1 = Valve plate (rocker)

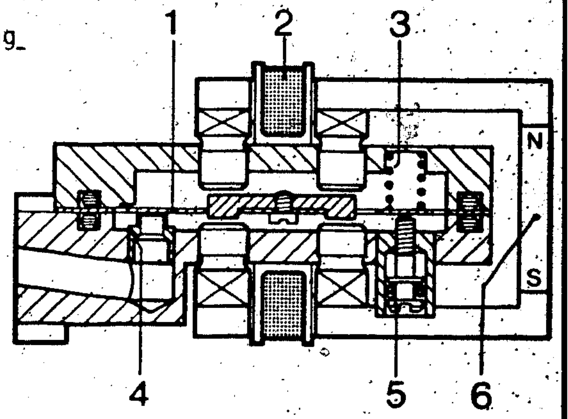
2 = Magnetic coil

3 = Spring

4 = Fuel-inlet bore

5 = Adjusting screw for the fundamental moment

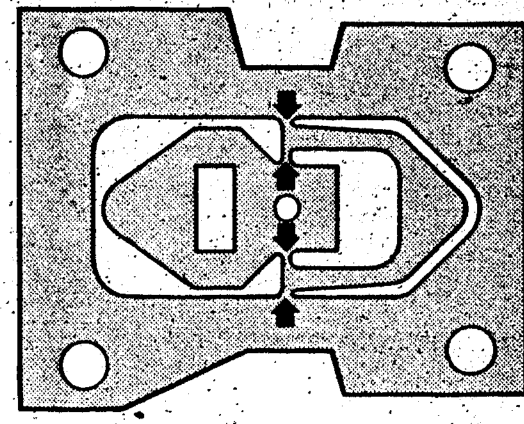
6 = Permanent magnet



## Function of the electromagnetic pressure-correcting element:

The pressure-correcting element is fitted with a valve plate in the form of a rocker. The deflection moment of the rocker is varied electromagnetically by the current signal from the ECU. The fundamental moment of the rocker is fixed and is determined by the pretension which opposes the inherent stiffness of the rocker at the pivot point and by the effect of an additional permanent magnet. The valve plate is arranged so that it presses with a defined force against the fuel-inlet port in the pressure-correcting element. This press-on force, and with it the pressure drop, are variable depending upon the elecromagnetic flux.

Fig. 8 Valve plate (rocker), suspended upon spring bridges (arrows)



The change in the pressure drop at the pressure-correcting element leads, as described above, to a change in the differential pressure in the fuel distributor and, as a result, determines the air-fuel mixture composition.

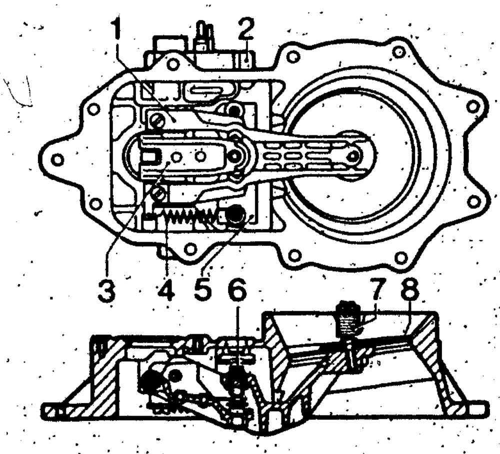
The fundamental moment of the rocker as described above, is chosen so that when the pressure-correcting element is without current, a basic differential pressure is controlled which corresponds to engine operation at Lambda = 1 (limp-home facility without correcting functions).

## Air-flow sensor:

As is the case with the K-Jetronic, both updraft and downdraft air-flow sensors are in the programme. The main-lever counterweight is omitted and, instead, a return spring is fitted in the downdraft-type air-flow sensor. In this type of sensor, the sensor plate is fitted obliquely in order that the annular orifice in the cylindrical section of the air funnel can be kept as small as possible. The cylindrical section in the air funnel is about 4 mm high in the KE-Jetronic and 1 mm high in the K-Jetronic.

Fig. 9 Air-flow sensor:

1 = Main lever
2 = Potentiometer
3 = Intermediate lever
4 = Return spring
5 = Spring stop
6 = Idle mixture screw
7 = Rubber stop
8 = Sensor plate



All KE air-flow sensors are equipped with a potentiometer for electrical determination of the sensor-plate position. The potentiometer wiper is fixed to the bearing pin of the main-lever bearing and follows its rotational movement. The potentiometer casing is screwed to the air-flow sensor housing and can be adjusted by means of slots.

Above all, the voltage signal from the potentiometer is evaluated by the ECU for the determination of the acceleration enrichment. Here, the degree of enrichment depends upon the steepness of the signal flank and upon the signal magnitude as well as upon the engine temperature.
The signal from the potentiometer can also be utilized for the display of MPG, and for further matching to the paricular engine operating mode.

Temperature sensor (NTC-resistor):

The temperature sensor is familiar from other electronically controlled fuel-injection systems. It is fitted in a position which is representative for the engine temperature and registers the engine temperature continuously. The signal from the sensor is evaluated for the control of all temperature-dependent corrective functions.

Throttle-valve switch:

Two throttle-valve switches are fitted to the throttle-valve assembly for determining the throttle-valve positions "idle" and "full load". The signals from these switches are evaluated by the ECU and used for the triggering, or suppression, of various corrective functions.

Description of the ECU functions:

Start enrichment:

For this function, maximum current is applied to the pressure-correcting element, i.e. maximum enrichment. Enrichment is triggered upon the starting motor being operated, and ends after a given period of time. The start enrichment is independent of temperature i.e. maximum enrichment takes place every time the engine is started.

Post-start enrichment:

For the purposes of air-fuel mixture adaptation immediately after starting, a time-controlled correction takes place the initial value of which is dependent upon temperature. This facility is triggered as soon as the starting motor stops turning. The control-function time is also temperature-dependent.

Warm-up enrichment:

Warm-up enrichment also takes place when the engine is still cold and during the warm-up phase. The degree of enrichment corresponds to engine temperature at start and is slowly reduced to zero as the engine temperature increases. The enrichment is zero when the coolant has reached a temperature of approx. 50 °C.

Acceleration enrichment:

The air-fuel mixture is enriched briefly when optimum acceleration is required. The degree of enrichment depends upon the engine temperature and upon the magnitude and flank steepness of the voltage signal arriving from the potentiometer on the air-flow sensor, i.e. it is dependent upon the throttle valve upon opening speed and upon the distance travelled by the throttle valve upon opening.

The time required for control to reduce to zero in the case of the acceleration enrichment is within the 1 to 2 secs range.

During starting and when the throttle valve is closed, acceleration enrichment is suppressed.

Full-load enrichment:

Full-load enrichment is triggered by two signals:

- "Full-load" signal from the throttle-valve switch.
- Engine speed within specific ranges.

Full-load enrichment only comes into force if both signals are present.

Overrun cut-off:

Overrun cut-off is triggered by the reversal of the direction of electric current at the pressure-correcting element. Due to the function of the differential-pressure valves in the fuel distributor, this leads to the interruption of the fuel injection.

Overrun cut-off takes place above given engine-speed thresholds, it is only triggered though, as a result of the signal from the "idle" switch, when the throttle valve is closed.

The cut-in speed of the fuel-injection during overrun is very near to the idle speed of the engine when the temperature is above 60 °C. For reasons of driveability, the cut-in point is at a higher temperature when the engine is cold.

Further functions:

According to requirements, further fuctions can be added to the KE-Jetronic such as Lambda control and knock control without modifications being necessary on the mechanical-hydraulic system . To this end, appropriate sensors are used (Lambda sensor, knock sensor) the signals from which are evaluated by the ECU.

FITTING POSITION AND MARKING OF AIR-FLOW SENSOR PLATE 3 430 100 ..

VDT-I-Gen. 060 En

10.1983

In air-flow sensors for K and KE-Jetronic

## General information/fitting position

As a result of the stamping process during manufacturing, air-flow sensor plates have a sharp and a slightly rounded edge around the circumference. The sharp edge serves for measuring the air flow and must therefore be fitted so that it faces the air stream.

- The sharp measuring edge of the air-flow sensor plate points in the direction of the air filter.
- The slightly rounded edge points in the direction of the air funnel and intake manifold. 6 and 8 cylinder mixture-control units with downdraught air-flow sensor have air-flow sensor plates with a bezel on the otherwise usual rounded edge.

## Marking

- Up till now most air-flow sensor plates have been marked on a surface with 5 punch marks or with the word "TOP". This marked surface must always be at the top of the air-flow sensor. This applies to both updraught and downdraught air-flow sensors.
- For precision reasons, an increasing number of air-flow sensor plates will be ground at the circumference during production as from mid-1983. On account of the sharp-edged surfaces on both sides, there will be no marking of any kind. These air-flow sensor plates can be fitted whichever way is desired.

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KE3-JETRONIC

After-Sales Service procedure 8.1986

## Brief description of system

The KE3-Jetronic differs from the basic versions KE1 and KE2 with respect to the following features:

* control unit with microprocessor and characteristic-map control (externally influencible using coding plug), extended scope of operation.

* Electronically controlled idle-speed control with single-winding rotary actuator. (without bypass adjusting screw).

## User:

DB is the first vehicle manufacturer to use the KE3-Jetronic. It is equipping the 300E (Type W124) with the KE3. Start of production 1.85.

## Components:

| | |
|---|---|
| Air-flow sensor | 0 438 121 .. |
| Fuel distributor | 0 438 101 .. |
| Control unit | 0 280 800 .. |

Detailed equipment data are given on the respective vehicle-equipment microcard AP....

Spare/Exchange parts

The air-flow sensor can be repaired to some extent (see spare-part microcard EE 00 under 0 438 121 ..).
For exchange parts, see exchange microcards WB 01 and exchange price list PD 02.

Test concept:

Testing of the system in the vehicle is performed with the universal test adapter in conjunction with a special adapter lead together with a commercially available multimeter.
Special tools are not required.

Testers:

Universal test adapter ETT 018.01
Part No. 0 684 101 801
Adapter lead
Part No. 1 684 463 169

Delivery via usual route (technical equipment supplier BG, RG/AV).

Technical documents:

Trouble-shooting instructions and test specifications:
SIS microcard MB... (see General microcard KFZ 000).

System training:

Integrated into the technical courses for K-Jetronic and Jetronic Special.

Retrofitting:

This system is not designed for retrofitting.

**Warranty procedure:**

a) West Germany
Components subject to complaint during the warranty period are to be sent for warranty assessment via the BG responsible to:

K3/QSG
Wareneingang
Am Boschwerk
7000 Stuttgart 30

with warranty application G 20
and delivery note KH/VKD3 - 15333

b) Other countries

Components subject to complaint during the warranty period are to be sent for warranty assessment to our representative responsible in your country.

Published by:

ROBERT BOSCH GMBH
Division KH
After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.



B21

# New Product



## L-Jetronic – New control-unit functions



- Lambda closed-loop control
- Acceleration enrichment
- Overrun cut-off
- Engine-speed limitation
- Start control
- Increased fuel for drive-off
- Anti-search circuitry
- Pulse-period limitation

### 1. Lambda closed-loop control

A number of passenger-car manufacturers install an exhaust-gas control system developed by Bosch – the Lambda closed-loop control – for the vehicles that they export to California and to Japan.

Following the fitting of K-Jetronic equipped vehicles with Lambda closed-loop control, vehicles are now available with a combination of L-Jetronic and this system.

Even though the Lambda control represents an extension of the L-Jetronic, the basic principle of the L-Jetronic has not changed.

#### General

Lambda closed-loop control together with a single-bed catalyst offers advantages in every respect. The single-bed catalyst is able to adequately decompose all three toxic components ($CO$, $CH$ and $NO_x$), see Fig. 1. A decisive prerequisite though, is the fact that the composition of the air-fuel mixture must be controlled to a high degree of accuracy. That is, the engine must be operated with a mixture sufficiently near to the stoichiometric ratio. An optimal solution is provided by the use of the Lambda closed-loop control.
At the same time this value (air-fuel ratio $\lambda = 1$) is situated very close to the minimum fuel-consumption point and driveability is not adversely affected at all.

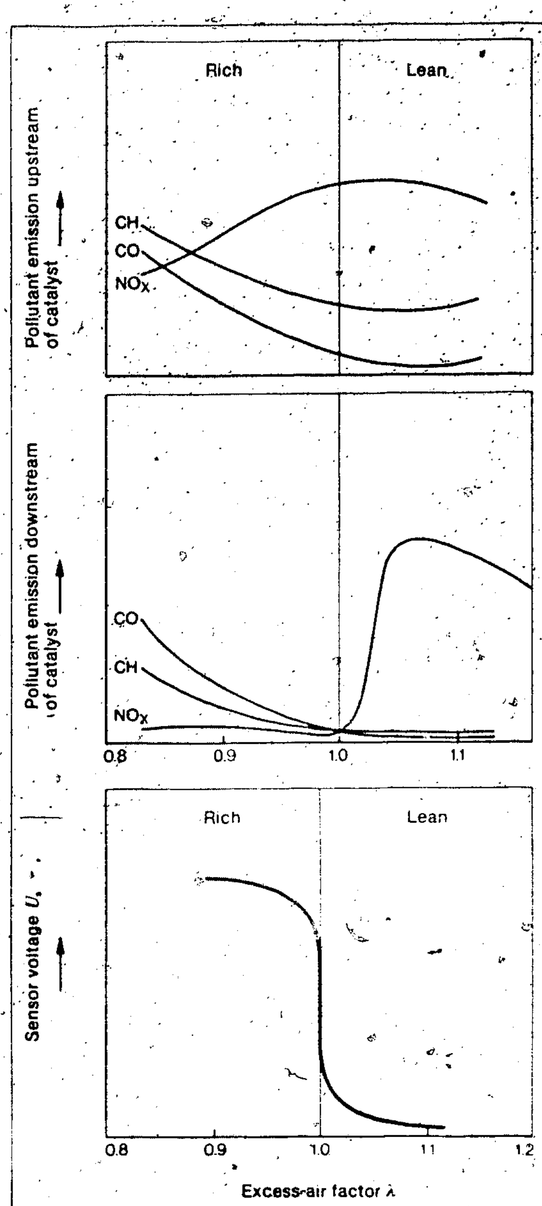


Fig. 1

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B22

## The [illegible] Lambda closed-loop control
(see also: Technical Bulletin VDT-I-438/2)

The principle of this closed-loop control (Fig. 2) is based upon the fact that the exhaust gas is constantly monitored by the Lambda sensor and the injected fuel quantity corrected in accordance with the monitoring results. The Lambda sensor, functioning as a detecting element in the exhaust pipe, provides information on whether the air-fuel mixture is "richer" or "leaner" than $\lambda = 1$. At $\lambda = 1$, the sensor output-signal voltage suddenly jumps as shown in Fig. 1. This voltage jump is used by the control unit to ensure that the air-fuel mixture remains stoichiometric.

## Lambda-sensor construction
(see also: Technical Bulletin VDT-I-438/2)

Fig. 3 shows the construction of the Lambda sensor.
The sensor ceramic is fitted in a housing which protects it from mechanical damage and which also serves for mounting.

The ceramic body is mainly composed of zirconium dioxide. Its surfaces are covered with thin, porous, platinum layers which act as electrodes. The outer surface, which is exposed to the exhaust gas, is also covered with a porous ceramic layer which protects the electrode surface from contamination due to the combustion residues in the exhaust gas. The inner surface of the hollow ceramic body is exposed to the surrounding air.

## Principle of operation of the Lambda sensor
(see also: Technical Bulletin VDT-I-438/2)

The Lambda sensor, also known as the oxygen sensor, measures the oxygen content of the exhaust gas. This varies, depending upon whether the air-fuel mixture is "rich" or "lean". It is the particular feature of the Lambda sensor that deviations in the air-fuel mixture away from the stoichiometric ratio ($\lambda = 1$) result in an immediate change of about 800 mV in the sensor output voltage.

The principle of operation is based on the fact that the ceramic material used becomes conductive for oxygen ions above about 250°C. If the oxygen content on one side of the sensor ceramic is different to that on the other then, due to the particular characteristic of the material used, a voltage is generated between the two border zones. This voltage is a measure for the difference in the oxygen content between one side of the ceramic body and the other. In other words: the difference between the oxygen content in the exhaust gas and that prevailing in the surrounding air.

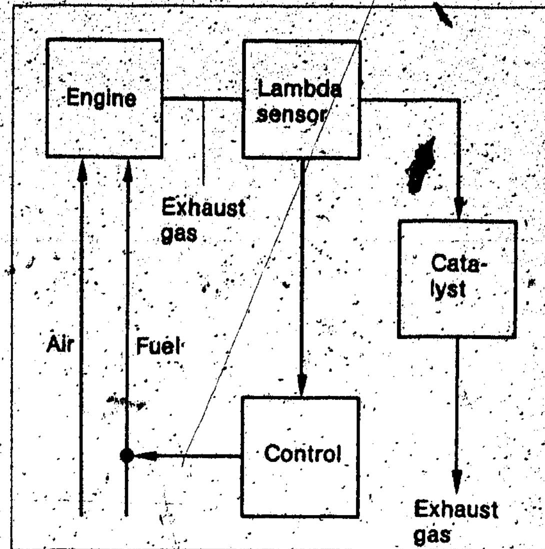



Fig. 2

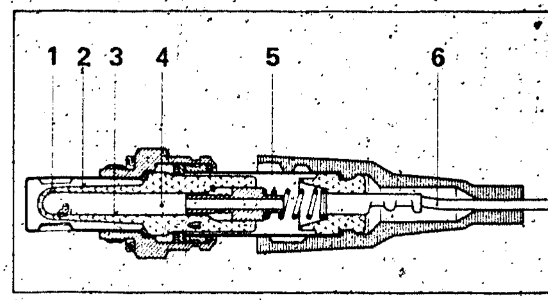



Fig. 3

1 = Zirconium dioxide
2 = Platinum-coated outer surface
3 = Platinum-coated inner surface
4 = Air
5 = Air entrance hole
6 = Lead

## Closed-loop control

Closed-loop mode: In this case, all corrective data and the sensor voltage are evaluated and the air-fuel mixture brought to $\lambda = 1$.

Open-loop mode: In this case, the sensor voltage has no effect (the control unit is presented with a constant simulated sensor voltage) but all other corrective data remain in effect. In order to prevent excessively lean mixture been injected permanently if the sensor should become defective, the control function is monitored continuously. If a defect should occur, the system is switched to the open-loop mode.

### Lambda sensor monitoring

Closed-loop control cannot come into operation until the Lambda sensor has reached its operating temperature. During the warm-up phase the system is switched to the open-loop mode.

### Full-load operation

In some cases it is required, for performance reasons, that at full load a mixture is made available which deviates from the value $\lambda = 1$. This fact is provided for in the control circuitry of the control unit which, though, requires notification of the full-load state before it can bring this facility into operation. This notification can come for instance from a throttle-valve switch. During the functioning of this facility, the system is switched over from closed-loop to open-loop mode (matched to the engine in question).

## 2. Acceleration enrichment (BA)

### Description of function

In order to gain good acceleration response, some control units have been fitted with an acceleration-enrichment circuit. This became necessary on those engines where the normal acceleration enrichment due to the overswing of the sensor flap in the air-flow sensor was insufficient. In the case of the electronic acceleration enrichment, the voltage-change signal from the air-flow sensor is evaluated and used as the triggering impulse. If the voltage change reaches a certain level, then the acceleration enrichment is triggered. In practice, this is equivalent to the sensor flap having travelled a certain distance in a given time. In addition, a given voltage jump must be overcome. This means that the injection signal is increased by a certain amount.

The magnitude and period of this value depend upon a number of points:

- When the engine is warm the enrichment must either be suppressed or reduced to a certain value.
- The acceleration enrichment is not used during starting, neither must it come into operation when the accelerator pedal is released during gear changes.
- Due to the non-linear functional characteristic of the air-flow sensor with respect to the air quantity, after a particular air quantity has been reached acceleration enrichment is no longer triggered.

## 2. Overrun cut-off

Overrun cut-off is controlled according to engine speed and the idle switch. Here, at the transition to overrun (idle contact closed) the fuel is cut-off (injection pulses stop) if transition takes place above the so-called cut-off speed.

When the engine speed drops below the cut-in speed or the idle contact opens, fuel supply is resumed again (injection pulses).
During the complete cut-off period, the injection pulses are suppressed fully, and the Lambda closed-loop control is switched to open-loop mode.
The cut-off speed is determined by the coolant temperature, whereby the cut-off speed increases along with a reduction in the engine temperature. Particular attention is to be paid to the setting of the throttle-valve switch. If the idle contact opens too late (> 1° throttle-valve switch setting) then the response of the engine when leaving the overrun phase is extremely poor (pronounced flat spot).

## 4. Engine-speed limitation

The engine-speed limitation by means of the ignition, as used up to now, operates on the principle that when a given engine speed is reached the ignition is short-circuited by the distributor rotor.
This method can no longer be applied on engines fitted with a catalys* because gasoline which continues to be injected, could get into the catalyst without having been burnt beforehand. This results in thermal destruction of the catalyst. In this case, electronic engine-speed limitation is the obvious solution.

### Function

This circuitry is brought into operation by the control unit itself. The engine-speed-dependent signal is compared with a fixed reference signal and when both signals are the same a special circuit suppresses a definite number of injection pulses.

## 5. Start control

The quantity of additional fuel for starting depends upon the coolant temperature, the length of time required for the starting process and the engine speed. It is possible to maintain the initial starting-fuel quantity constant for a given period of time. As soon as the engine starts, the start quantity is abruptly reduced to the warm-up or the post-start quantity. In order to prevent the engine from "flooding" due to repeated attempts being made in rapid succession to start it, the control unit incorporates a "recovery time" facility.
This facility determines how many seconds must elapse before 2/3 of the initial starting-fuel quantity can be injected again.

## 6. Increased fuel for drive-off

This facility is triggered by the idle contacts in the throttle-valve switch. With the contacts closed, the facility is inoperative.
The "increased fuel for drive-off" serves to increase the amount of fuel injected over a given period when the engine is accelerated from idle (idle contacts open).
If the circuitry of this facility is connected to a supply voltage which can be varied by the engine-temperature sensor (NTC II), then the facility becomes temperature-dependent.

## 7. Anti-search circuitry

This facility prevents sudden changes in injection duration which would result from jumps in the engine speed. Depending upon the characteristic of the engine, this means that more or less smooth transitions from one operating mode to the other are achieved.
In practise, this ensures that in the case of sudden acceleration or when the foot is suddenly lifted from the accelerator pedal, the engine does not "search", in other words the transition is smooth from one mode to the other.
The anti-search circuitry is an electronic method of compensating for mechanical engine deceleration. The circuitry is triggered by jumps in engine speed, and reacts to both sudden acceleration and sudden deceleration.

## 8. Pulse-period limitation

This circuitry ensures that the duration of injection remains within specified limits (specific to the vehicle).

There are two possibilities:

- Lower-limit pulse-period limitation
- Upper-limit pulse-period limitation

Lower-limit pulse-period limitation comes into effect when the vehicle is in the overrun mode and the engine has high revs. If now the period of injection were not limited, the engine would be operated with an excessively lean mixture.
Upper-limit pulse-period limitation comes into effect when the vehicle is in top gear for instance, the engine is turning with low revs and the driver suddenly accelerates. If now the period of injection were not limited, the engine would be operated with an excessively rich mixture. This facility is triggered through the engine-speed information.

# New Product

(Exhaust Turbo-Supercharger System)

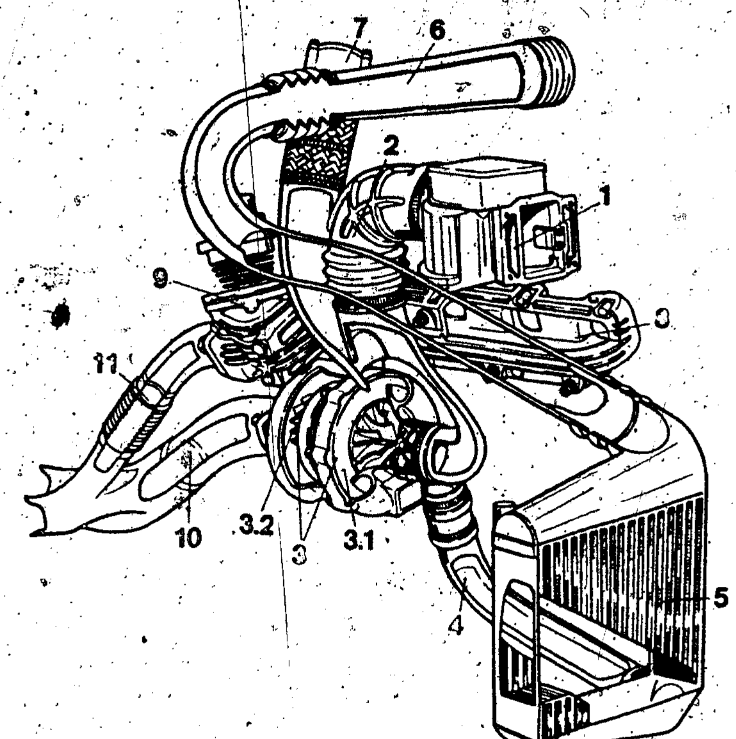
## L-Jetronic with exhaust turbo-supercharger

As from September 1980, BMW have been delivering the 745i model equipped with L-Jetronic and an exhaust turbo-supercharger.

### General:

The engine already in use in the 733i model, with L-Jetronic and a swept volume of 3,2 l, has been retained.

The intended increase in engine power has been achieved by fitting an exhaust turbo-supercharger specially adapted to this particular engine. The type designation 745i was chosen by BMW to signify this increase in power.




280/0200

1 = Air-flow sensor meters the air drawn in
2 = Intake tube
3 = Exhaust turbo-supercharger, comprising the turbine (3.2) which is driven by the exhaust-gas stream, and the compressor (3.1) which is rigidly fixed to the turbine.
4 = Charge-air tube
5 = Charge-air cooler
6 = Charge-air intake connection
7 = Air-control valve for controlling the charge-air pressure during overrun
8 = Exhaust manifold
9 = Bypass valve
10 = Exhaust pipe
11 = Exhaust bypass duct

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## Functional description of the exhaust turbo-supercharger:

The turbine (3.2) is driven by the speed of the exhaust gas. The turbine and the compressor (3.1) are rigidly connected to one another. The air is drawn in by the compressor through an intake-noise damper (1) on the air filter and then through the air-flow sensor (2). Following the compressor, the compressed air is routed to the charge-air cooler (4). Here it is cooled down and then drawn into the individual cylinders of the engine through the charge-air intake connection, the throttle valve and the intake manifold (9).

Due to the fact that the charge-air pressure must not exceed approx. 0.7 bar, it has to be controlled. This is carried out by means of a bypass valve (6) at the exhaust manifold. The compressor and the bypass valve are joined by a control line (7). The turbine and the bypass valve are connected by a pipe to the exhaust system (8). As soon as the charge-air pressure becomes excessive, the bypass valve opens and permits a fraction of the exhaust gas to be diverted to the bypass duct of the exhaust system. As a result, the pressure applied to the turbine becomes less and the charge-air pressure sinks.

The compressor operates when the throttle valve is closed (and particularly during the actual closing process), this can lead to unwanted pressure shocks in the charge-air intake connection. These are prevented by the air-control valve (5). The air-control valve is connected to the intake manifold by a vacuum hose. The vacuum which is generated when the throttle valve closes opens the air-control valve and the charge air is diverted through the bypass line to the intake side of the compressor.

## Functional description of the charge-air cooler:

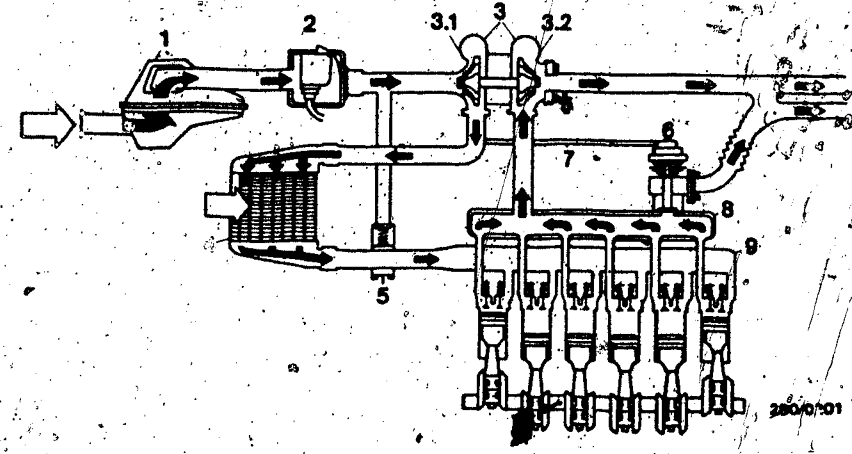
When the intake air is compressed in the turbo-supercharger compressor its temperature increases considerably.

This increase in intake-air temperature has two disadvantages:

1. The density of the air drops along with the rise in temperature and, as a result, the cylinder charge as well.

2. The combustion-chamber temperature rises and with it the thermal loading of the engine.

These disadvantages are prevented by the charge-air cooler.




1 = Air filter
2 = Air-flow sensor
3 = Exhaust turbo-supercharger
3.1 = Compressor
3.2 = Turbine
4 = Charge-air cooler
5 = Air-control valve
6 = Bypass valve
7 = Control line
8 = Exhaust manifold
9 = Intake manifold

## Differences in the fuel induction of this turbo-supercharged engine to that of the normally aspirated L-Jetronic engine

In order to increase the engine power, the following measures are necessary:

The metering range of the air-flow sensor has been extended by fitting a stronger counterspring at the sensor flap. The injected fuel quantity has been adapted to the increased intake-air quantity by raising the fuel primary pressure during pressure-charged operation and by increasing the cross-sectional area of the fuel-injection valves.

Three additional control-unit functions have been incorporated in the turbo-supercharged engine:

1. Engine-speed limitation is by means of injection-pulse switch-off instead of through the ignition-distributor rotor as is usually the case. The advantage of this method lies in the fact that in the switched off range no unburnt fuel can get into the exhaust system and, under certain conditions, burn there.

2. During overrun, with the throttle valve closed (idle contact in the throttle-valve switch closed) the supply of fuel is interrupted up to an engine speed of 1200 $min^{-1}$ by switching-off the injection pulses to the fuel-injection valves.

3. A safety circuit stops the supply of fuel to the engine, in case of excessive turbo-supercharger pressure, by switching-off the fuel-injection valves.

# New Product

VDT-I-280/4 En
10.1983

L-Jetronic (System Version LH 1)

(Replaces Ed. 5.1981)

## General

The LH 1 system version is a further development of the familiar L-Jetronic, but does not supersede it.

This version works on the same principle as the L-Jetronic, but differs in the following points:

- The flap-type air-flow sensor is replaced by a hot-wire air-mass meter.
- Digital circuitry and a microcomputer are used in the control unit.

The LH 1 version has been used for the first time by Volvo in their 242, 244 and 245 models for the USA.

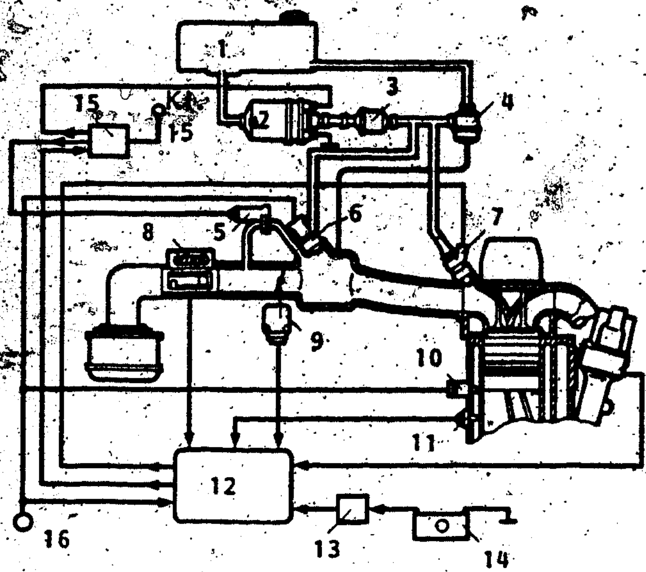



Fig. 1

1 = Fuel tank
2 = Electric fuel pump
3 = Fuel filter
4 = Pressure regulator
5 = Auxiliary-air device
6 = Start valve
7 = Solenoid-operated fuel-injection valve
8 = Hot-wire air-mass meter
9 = Throttle-valve switch
10 = Thermo-time switch
11 = Temperature sensor
12 = LH 1 control unit
13 = Main relay
14 = Battery
15 = Pump relay
16 = Ignition lock

Kl. = Terminal

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## Hot-wire air-mass flow meter (HLM)

### Design

The important components essential for the correct functioning of the HLM, i.e. the hot wire (platinum), the compensation resistor and the measurement resistor, are located in the HLM inner tube. The inner tube is fitted centrically in a cylindrical measurement channel. The required electronic control circuitry is contained in the cast-on control housing.

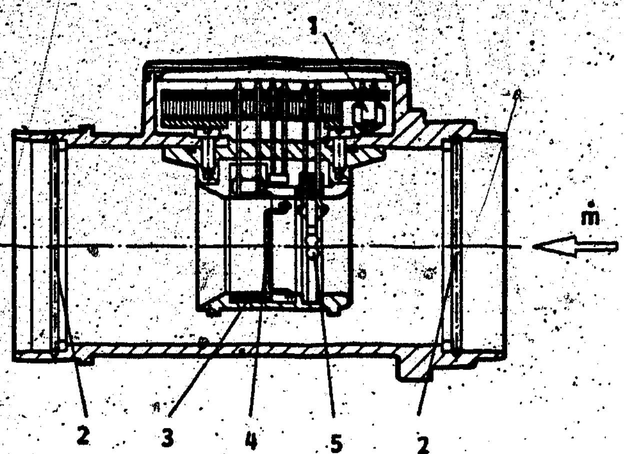



Fig. 2

Air-mass meter
(Sectional view)

1 = Idle CO-adjustment screw
2 = Protective grid
3 = Measurement resistor
(Manganin foil)
4 = Hot wire
5 = Intake-air compensation resistor

m = Air mass

Arrow = Air flow direction

The control housing also contains an idle potentiometer which can be adjusted from the outside. Adjustment of the potentiometer though, does not modify the HLM characteristic but directly changes the fuel metering via the control unit. On both, the inlet and outlet side, a wire grid protects the hot wire from mechanical effects.

## Method of operation

Together with an adjustable thick-film resistor ($R_2$), the hot wire, the measurement resistor and the compensation resistor are wired to form a bridge circuit. Using resistor $R_2$, the bridge is calibrated so that the temperature-dependent resistance of the hot wire is brought to a value corresponding to a temperature of 100° C above that of the intake air. The HLM control circuitry is so designed that the hot wire constantly remains at this temperature independent of the air-mass throughput (constant temperature control).

When the engine draws in more or less air, depending upon its operating conditions, the control circuitry varies the heating current through the hot wire so that its heat loss (which is more or less pronounced depending upon the air-throughput) is compensated for. The heating current flows at the same time through the measurement resistor across which it generates a voltage drop. This voltage drop is directly proportional to the inducted air mass. The voltage drop signal ($U_M$) is then processed in the control unit.

Variations in the intake air temperature are registered by the compensation resistor, which is also included in the bridge circuit, with the result that

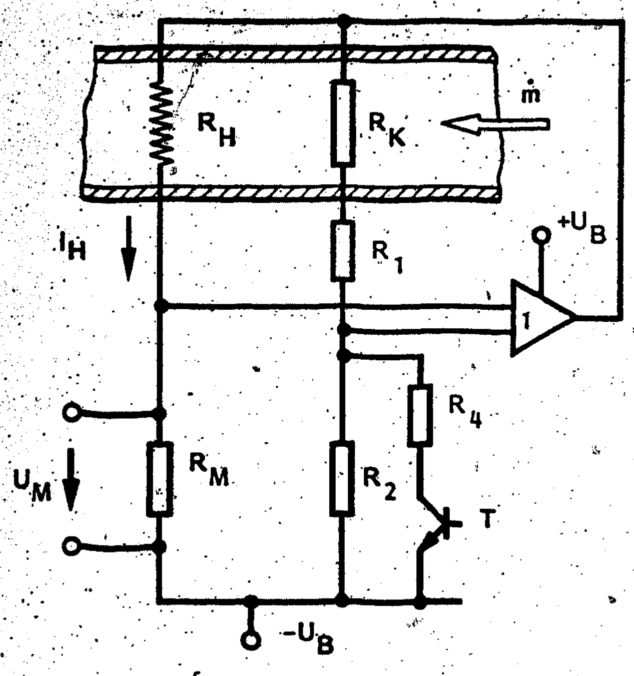



Fig. 3

Block diagram of the hot-wire air-mass meter

1 = Control amplifier

$R_K$ = Intake-air compensation resistor

$R_H$ = Hot wire

$I_H$ = Heating current

$R_H$ = Measurement resistor

$U_M$ = Output voltage (dependent upon the inducted air mass)

$R_1$ = Bridge resistor

$R_2$ = Calibration resistor (characteristic curve)

$R_3$ = Calibration resistor (burn-off temperature)

T = Burn-off transistor

$U_B$ = Voltage supply

ṁ = Air mass

the output voltage ($U_M$) is changed accordingly. The compensation resistor is of the platinum film type.

## Cleaning the hot wire by burn-off

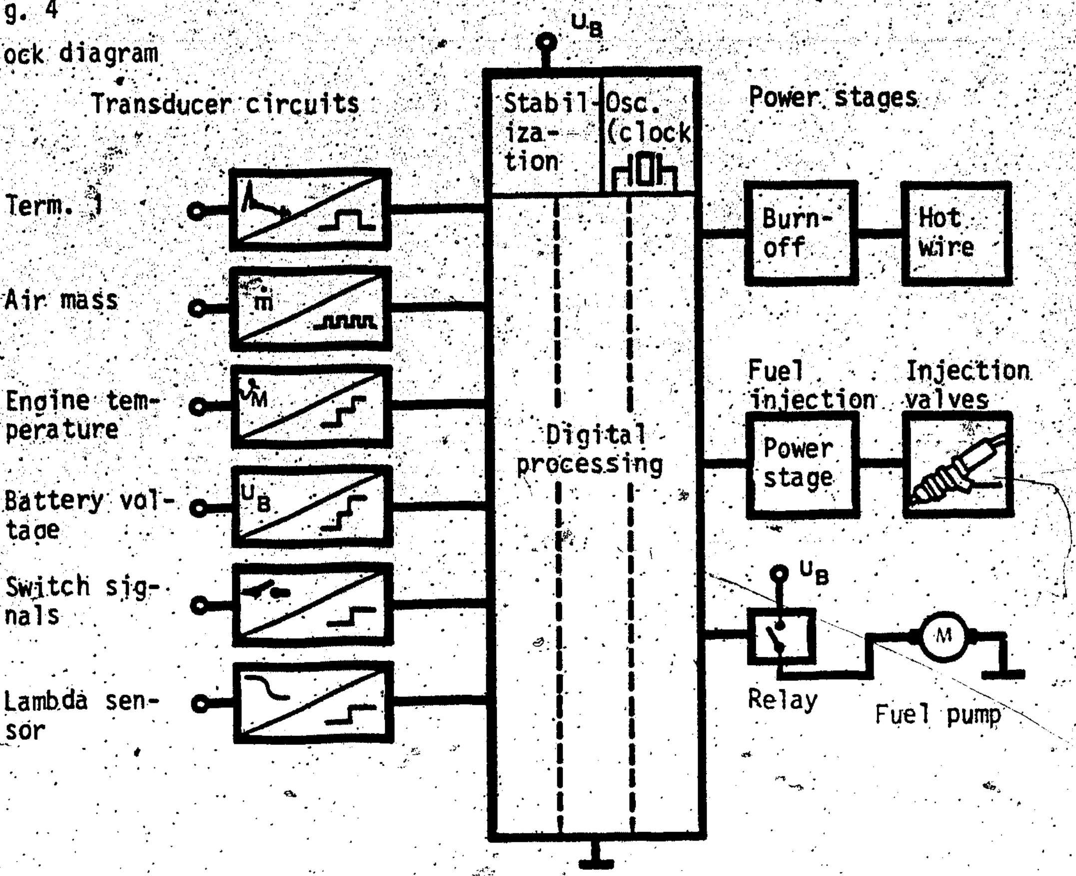
Due to the fact that the hot wire is located in the air-intake manifold of the engine, deposits can form on it which affect the measurement results. For this reason, every time the engine is switched off, the bridge circuit in the HLM is automatically set so that the hot wire heats up to a temperature of approx. 1000° C with the result that the deposits are burnt off. Burn-off does not take place if the engine speed is less than 200 min$^{-1}$ when the ignition is switched off (as is the case after an accident).

Digital control unit

Similar to the Motronic, the LH control unit is designed around a microcomputer. This enables precise processing of the signal from the air-mass meter to be achieved. The digital control unit facilitates the extension to include other control functions, and makes the adaptation to different types of engine considerably simpler. This means that this system has a future.

Fig. 4

Block diagram




The LH 1 version (digital) is based on the operating principle of the (analog) L-Jetronic. With the exception of the air-mass meter, the injection valves and the relay set, all the components have been taken over from the L-Jetronic. A considerable difference exists as regards signal processing. In the LH 1 version it is carried out digitally.

Further differences compared with the L-Jetronic.
A number of control-unit functions are the same as in the L-Jetronic, but are realized in a different manner (acceleration enrichment, overrun cut-off, voltage increase for starting, after-start enrichment and Lambda closed-loop control).

## Fuel-pump control

For reasons of safety, the fuel pump must not deliver fuel when the ignition is switched on and the engine is at a standstill. Therefore the pump only runs during starting and when the engine is in operation. Control of the external pump relay is carried out by a power transistor in the control unit.

## Special characteristics

The LH 1 control unit has a switched final stage. In principle, the fuel-injection valves are the same as those from the L-Jetronic, the difference being that the LH valves have a copper core and are without external series resistors.
If the hot-wire air-mass meter breaks down, the control unit is supplied with two load points, one for when the idle contact in the throttle-valve switch is closed and one for when it is open.
With the engine in warm operating condition, the vehicle can therefore still be driven ("limp-home" feature).

# New Product

VDT-I-280/5 En
10.1983

L-JETRONIC (System Version LE 1)

(Replaces Ed. 8.1981)

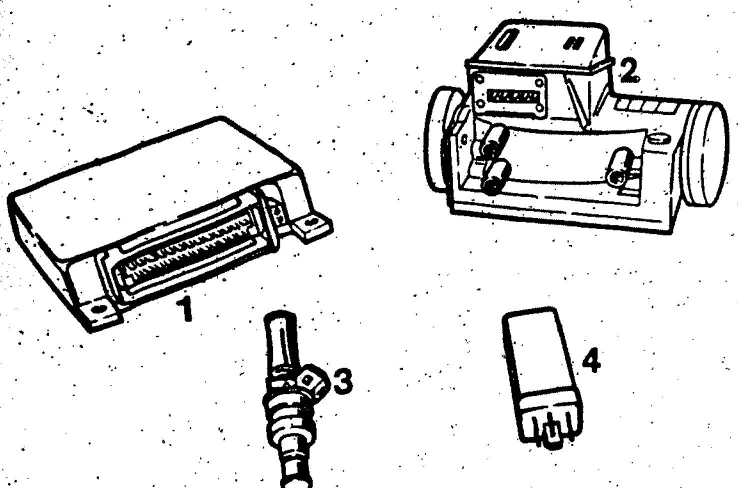
## General

The system version LE 1 is a further development of the familiar L-Jetronic with the aim of reducing costs. The LE 1 does not, however, supersede the L-Jetronic.

The method of operation of LE 1 differs only slightly from that of the traditional L-Jetronic. The overrun fuel-cutoff has been generally introduced as a measure to reduce fuel consumption.

The following components have been modified compared with the L-Jetronic:-

- Control unit
- Air-flow sensor
- Control relay
- Solenoid-operated fuel-injection valve




1 = LE 1 - control unit
2 = Air-flow sensor
3 = Solenoid-operated
fuel-injection valve
4 = Control relay

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## Control unit

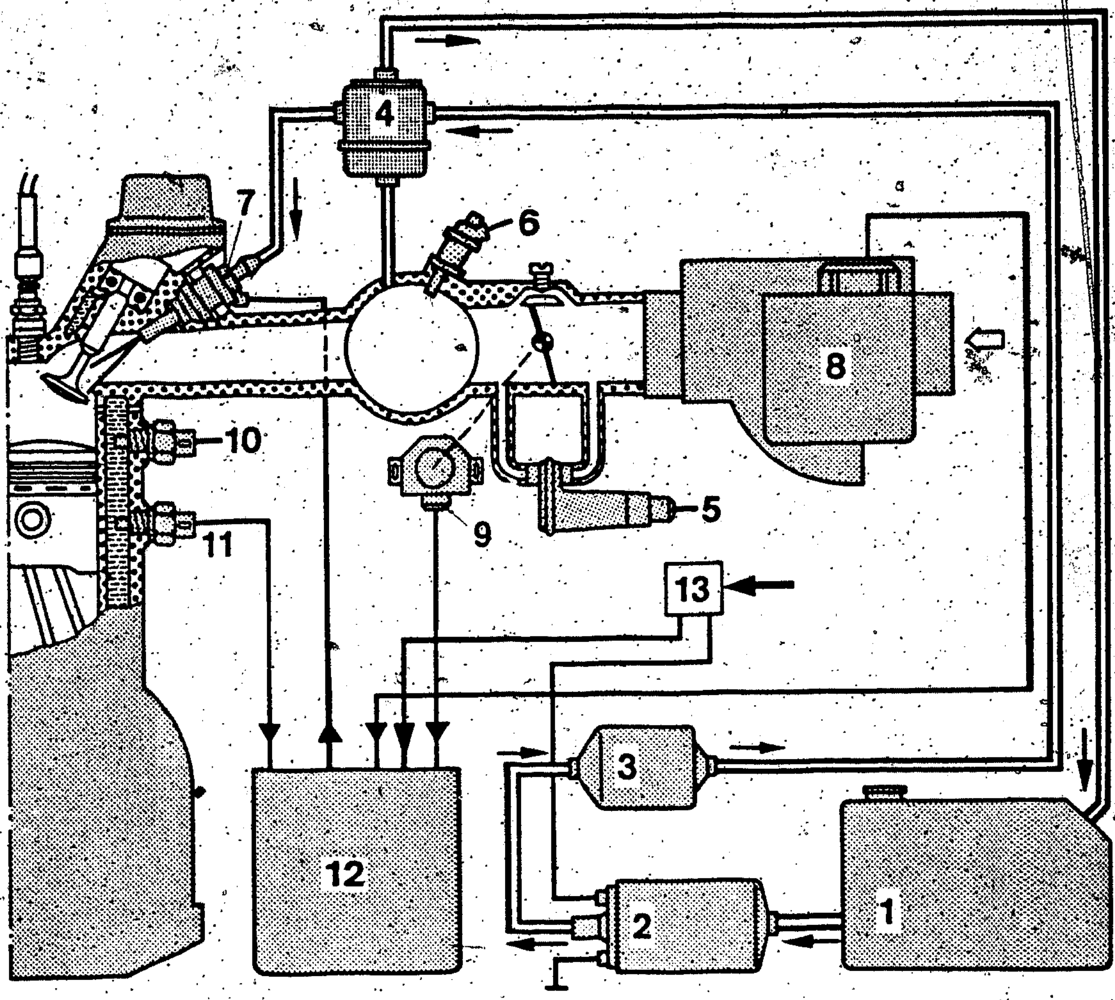
The circuitry of the control unit has been simplified. The electronic functions, though, remain unchanged.

Due to the simplification measures, the circuitry is considerably more compact and this means that the casing can be slightly reduced in size and is lighter. The connection plug has also been reduced to a 25-pin version.

Depending upon customer requirements, auxiliary and/or corrective functions can be incorporated in the control unit in order to adapt fully to the particular characteristics of the engine concerned.

## Available functions

- o Basic control
- o Increased fuel for starting
- o After-start fuel enrichment
- o Warm-up
- o Overrun fuel-cutoff
- o Acceleration enrichment
- o Full-load enrichment
- o Altitude compensation




1 = Fuel tank
2 = Electric fuel-pump
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5 = Auxiliary-air device
6 = Start valve
7 = Solenoid-operated fuel-injection valve
8 = Air-flow sensor
9 = Throttle-valve switch
10 = Thermo-time switch
11 = Temperature sensor
12 = LE 1 - control unit
13 = Control relay

## Available control-unit functions - scope of functions

**Input**

- Air quantity
- Speed/trigger
- Engine temperature
- Start signal term. 50
- Idle switch
- Full-load switch
- Battery voltage
- Atmospheric pressure (Height)

**Control-unit function**

- Increased fuel for starting
- Warm-up enrichment
- After-start enrichment
- Acceleration enrichment
- Full-load enrichment
- Anti-bucking function
- Pulse-time limiter
- Overrun fuel-cutoff
- Darlington output stage

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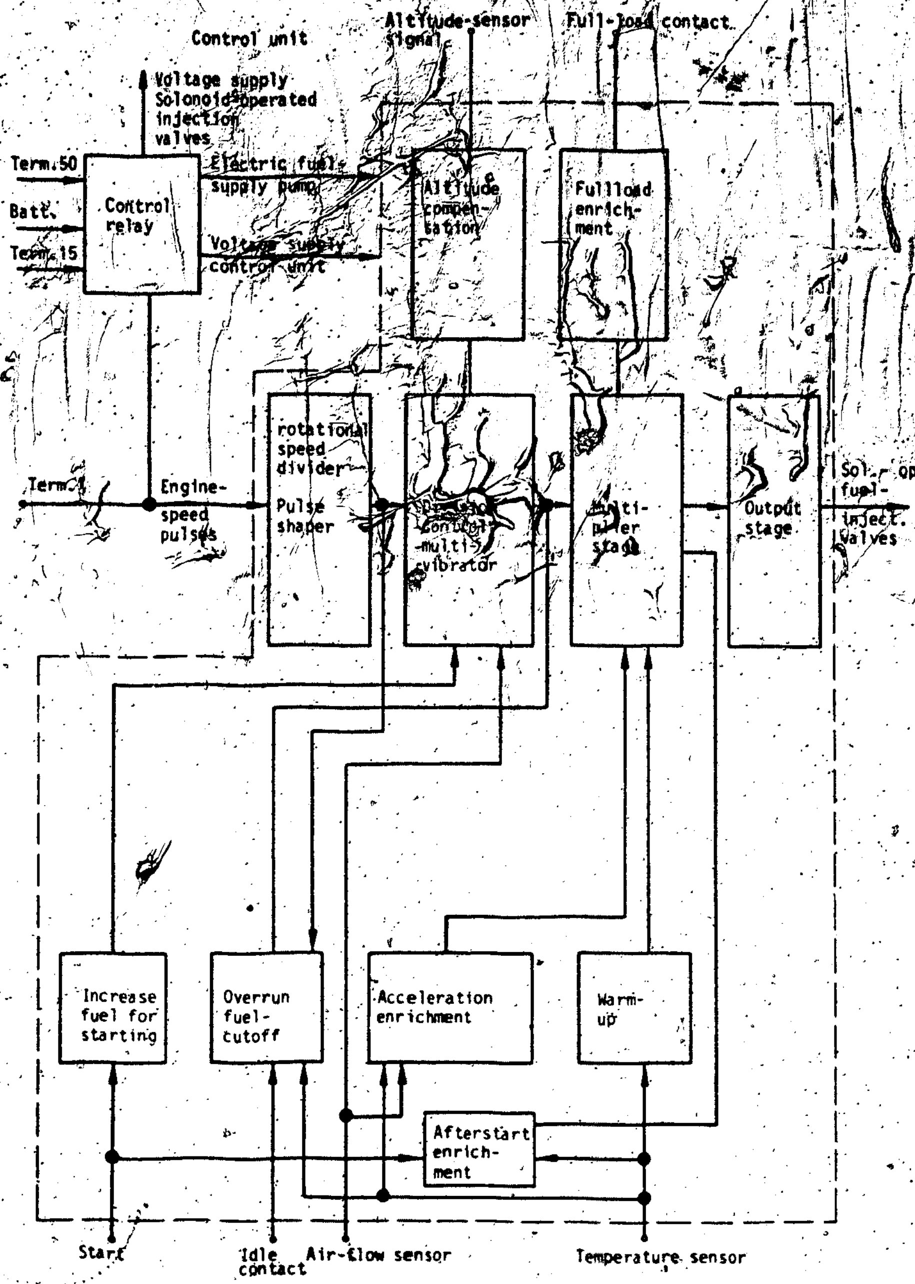
- Altitude compensation
- Air-flow-sensor damping
- Overrun-fuel-cutoff adaptation
- Overrun-cutoff narrower tols.
- Load-signal processing

**Output**

- Injection valves
- Load signal $t_p$ e.g. for consumption display

## Block diagram (LE 1 version)



## Air-flow sensor

The air-flow sensor has retained its shape and only the potentiometer chamber has been modified.

The pump contact has been omitted and the air-temperature sensor (NTC 1) is now integrated within the circuitry of the air-flow sensor.

Due to these modifications, the number of terminal points has been reduced from 7 to 5 (one of these terminals is the measurement point M or E, and is reserved exclusively for alignment and calibration at the works).

## Control relay

Due to the fact that the pump contact has now been omitted from the air-flow sensor, the fuel-flooding safeguard function has had to be transferred to another component. A control relay (rotational-speed relay) takes over this, as well as a number of other functions. During starting, voltage is supplied to the solenoid-operated injection valves and the electric fuel-supply pump through terminal 50 of the control unit.
When the engine has started, voltage continues to be applied only if the engine speed remains above 225 $min^{-1}$ for 4-cylinder engines and 150 $min^{-1}$ for 6-cylinder engines. The control relay receives information on the rotational speed from terminal 1 of the ignition coil.
The relay set has been replaced by this control relay.

## Solenoid-operated injection valves

The control unit has a switched final stage for solenoid-operated injection valves with brass solenoid winding.
Due to the former series resistors now being omitted, resistance has had to be transferred to the injection valves themselves. This has led to the development of a brass solenoid winding in place of the one made of copper (brass has a higher specific resistance than copper).

# New Product



L-JETRONIC (SYSTEM VERSION LE 2 AND LU)

## 1. System version LE 2

### General

A further development of the LE 1 version (see VDT-I-280/5, Ed. 2) has become necessary since more and more control-unit functions are required.

The LE 1 version will remain.

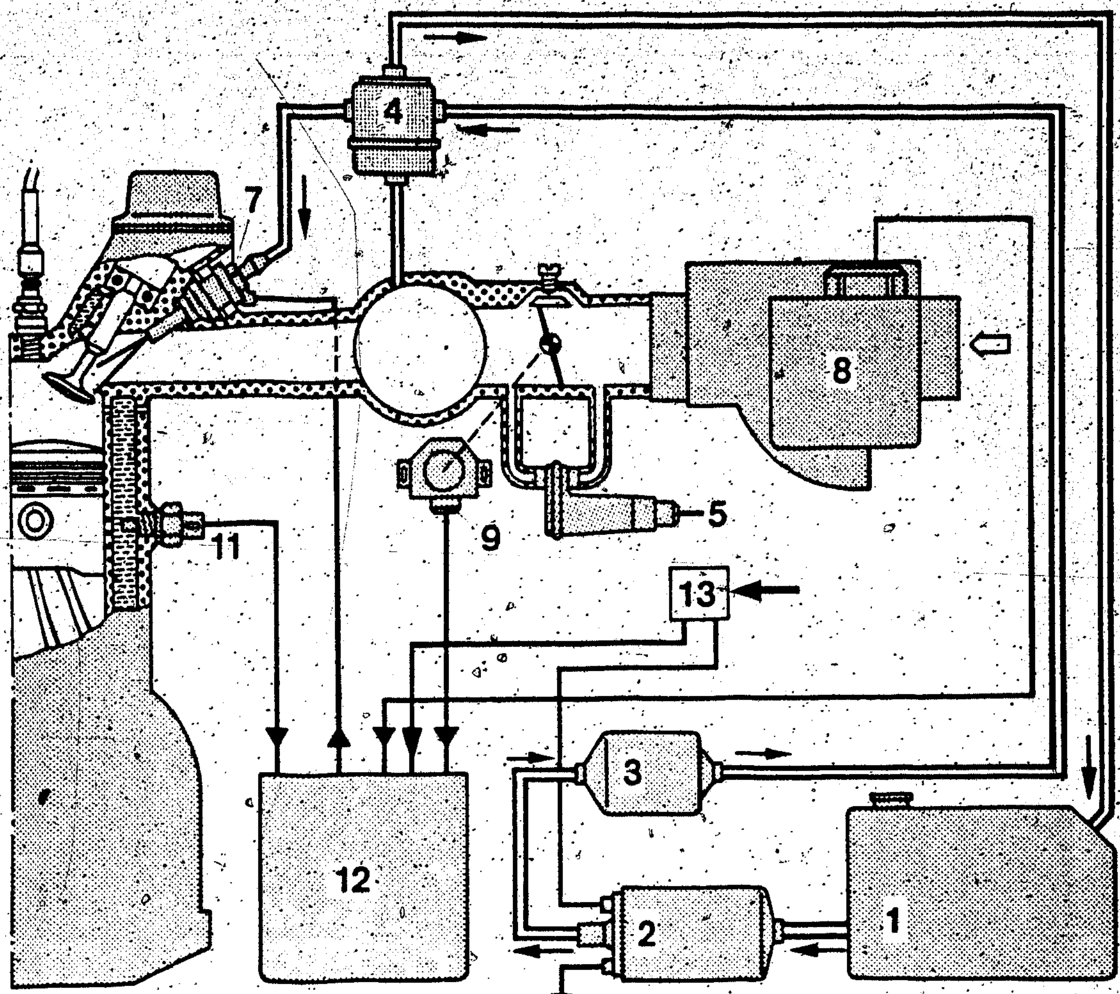
The differences from the LE 1 version are principally:

- o start control
- o adaptive overrun fuel-cutoff.



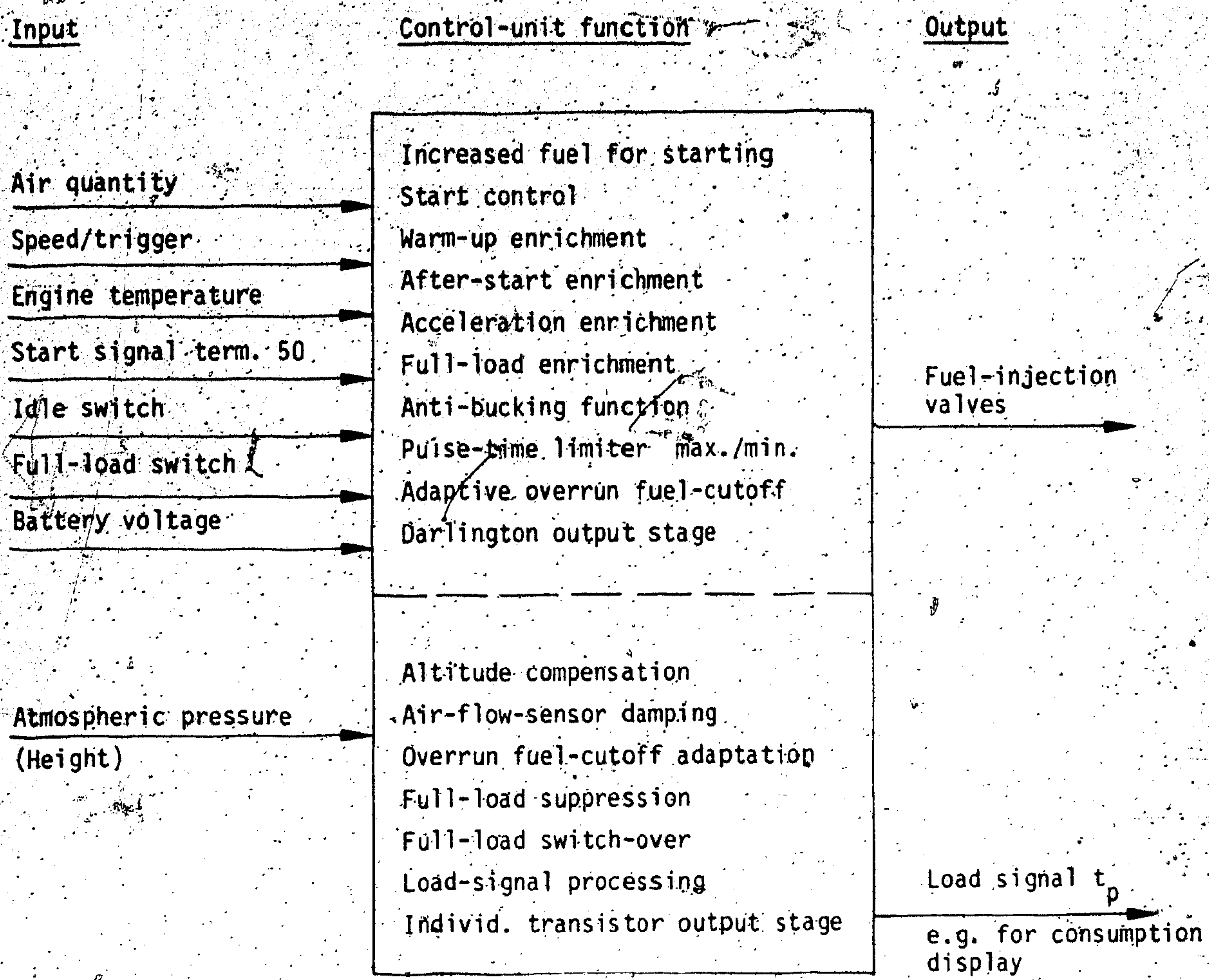
C11

Complete system




1 = Fuel tank
2 = Electric fuel pump
3 = Fuel filter
4 = Pressure regulator
5 = Auxiliary-air device
7 = Solenoid-operated fuel-injection valve
8 = Air-flow sensor
9 = Throttle-valve switch
11 = Temperature sensor (water)
12 = LE 2 control unit
13 = Control relay

## Available control-unit functions - scope of functions




### Start control

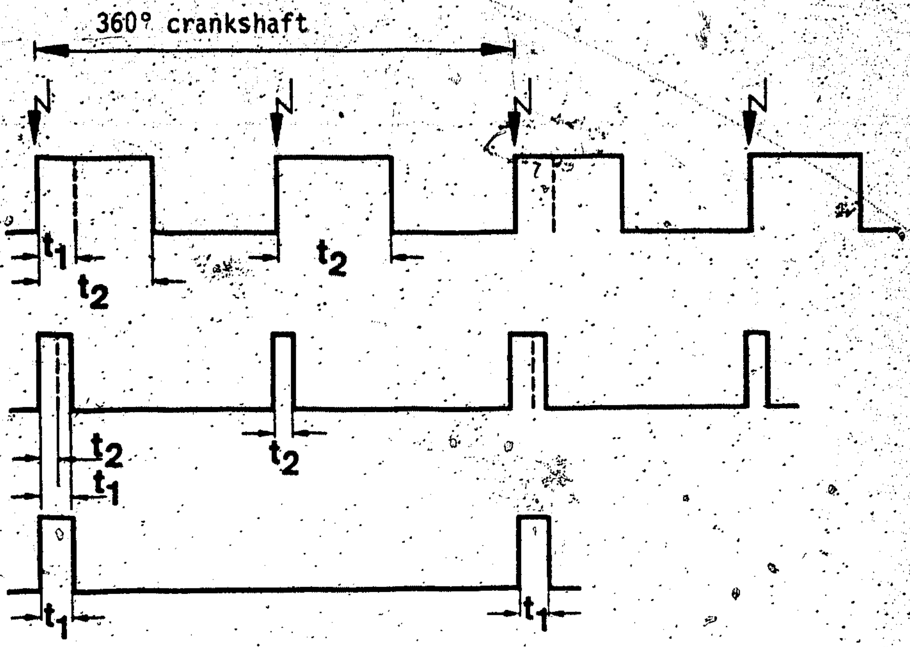
With the start control the fuel enrichment for starting is not carried out by a separate start valve, but by the normal solenoid-operated fuel-injection valves. A start valve and thermo-time switch are not therefore necessary. The magnitude of the injection impulse for the start control is dependent on the following factors:-

o coolant temperature (engine temperature)
o starting speed of the engine
o duration of the starting process

### Method of operation

The start control only operates when the starting motor is switched on. The injection impulses of the start control are triggered synchronously with each injection impulse.
The injection impulses of the start control are superimposed on the normal starting procedure, or they are given as an additional starting impulse between the normal injection impulses.

Injection impulses during starting




$t_1$ = Starting impulse

$t_2$ = Start-control impulse

Diagram of the start-control impulse (4-cylinder engine)

To improve the mixture preparation, injection is carried out at the beginning of each starting procedure (with a cold engine) with each ignition impulse, i.e. twice per crankshaft revolution (with a 4-cylinder engine). The impulses $t_2$ formed by the start control are superimposed on the normal injection impulses $t_1$ (once per crankshaft revolution).

When the starting time is longer, the start-control impulse becomes shorter. If the engine starting-speed is also increased, there is no start-control impulse and from that moment only the normal quantity of fuel for starting is injected.

## Adaptive overrun fuel-cutoff (adapted to needs)

In the development of the LE 2 version, the overrun fuel-cutoff function has been revised with the following aims:-

o Reduced fuel consumption and increase in driving comfort

 * Lowering of the engine speed at which fuel is supplied again (reinstatement speed).

o Increasing operational safety

 * In cases of rapid drops in engine speed (e.g. declutching), the falling engine speed must be halted before the overrun fuel-cutoff takes effect.

o Avoiding idle hunting

 * As the result of excessive idle speed during the warm-up phase
 * During idle phases after periods with the engine stationary, or
 * In connection with an idle-speed regulation.

This type of overrun fuel-cutoff has been realized in a control unit which makes the above mentioned advantages possible by early recognition of the influences and by suitable electronic measures to combat them.

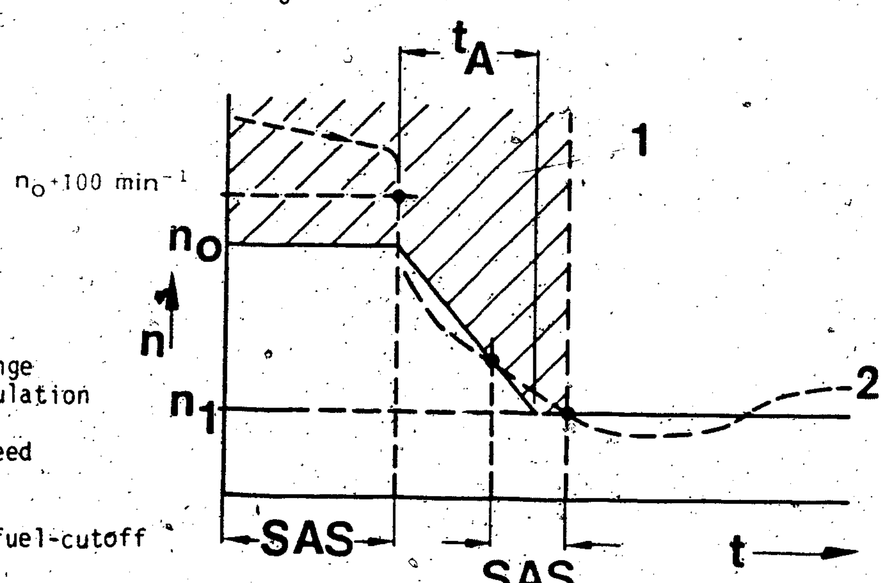
### Method of operation

The static engine-speed threshold $n_1$ i.e. when the engine is switched on again, is superimposed by threshold value $n_0$ (dynamic reinstatement speed) when the idle contact in the throttle-valve switch closes (when accelerator pedal is no longer pressed). Regulation (regulation time $t_A$) of the speed threshold $n_0$ begins when:

o the engine speed has reached the value $n_0$ + 100 $min^{-1}$ or when

o the engine speed is lower than $n_0$ when the idle contact closes.

### Example



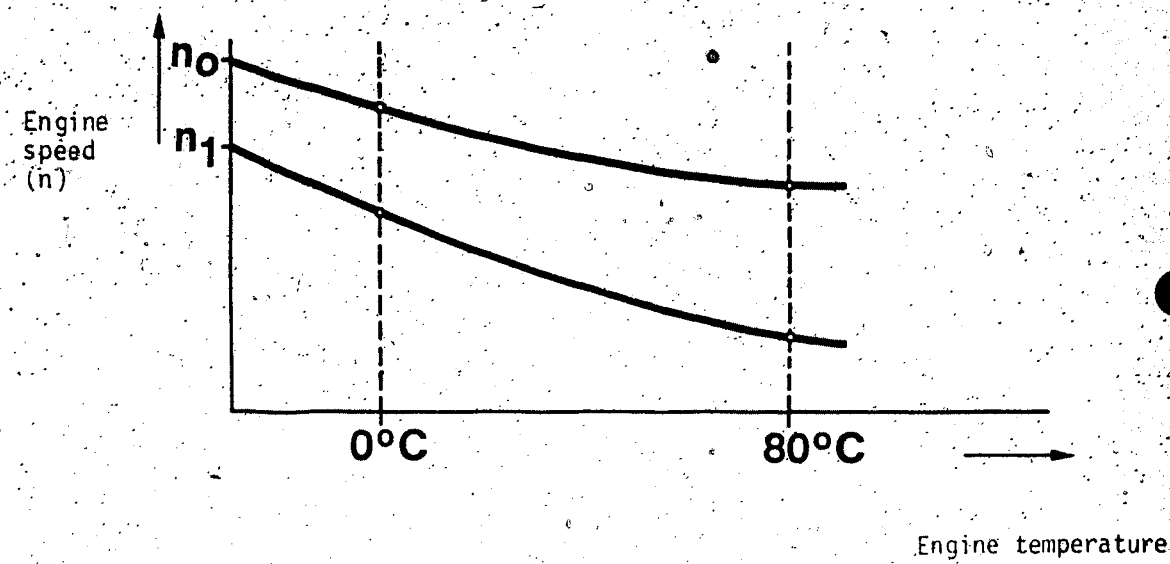

1 = Cutoff range
$t_A$ = Speed-regulation time
2 = Engine speed

SAS = Overrun fuel-cutoff

Slow regulation of the injection time (gentle introduction) is also possible with the adaptive overrun fuel-cutoff.

Temperature dependency

The engine-speed threshold values $n_1$ and $n_0$ at which the engine is switched on again, are dependent on the engine temperature.



## 2. System version LU

This version of the L-Jetronic is used in vehicles in countries with unleaded gasoline.
This version is based on the LE 2 version:
All important functions have been taken over and the Lambda closed-loop control as well as the engine-speed limitation have also been included. The circuitry of the control unit is constructed on the basis of analog technology as with the LE versions. The use of hybrid components has made it possible to accomodate a large number of circuits on the same size of printed-circuit board.

### Available control-unit functions - scope of functions

**Input**

- Air quantity
- Speed/trigger
- Engine temperature
- Start signal term. 50
- Idle switch
- Full-load switch
- Battery voltage
- Overrun fuel-cutoff prevented
- Lambda sensor
- Lambda postponement coding
- Atmospheric pressure (Height)

**Control-unit function**

- Increased fuel for starting
- Warm-up enrichment
- After-start enrichment
- Acceleration enrichment
- Full-load enrichment
- Anti-bucking function
- Pulse-time limiter max./min.
- Adaptive overrun fuel-cutoff
- Darlington output stage
- Lambda closed-loop control

- Altitude compensation
- Air-flow-sensor damping
- Engine-speed limitation
- Full-load suppression
- Full-load switch-over
- Load-signal processing

**Output**

- Fuel-injection valves
- Measuring output Lambda closed-loop control
- Sensor monitoring
- Load signal $t_p$ e.g. for consumption display

## 3. Testability

The universal test adapter with the same adapter cable for all three versions is available for testing the Jetronic versions LE 1, LE 2 and LU.

In connection with e.g. a commercially available multimeter, the wiring harness and peripheral components of versions LE 1, LE 2 and LU can be tested.

Part numbers

| | |
|---|---|
| Universal adapter | 0 684 101 801 |
| Adapter cable | 1 684 463 123 |

# New Product



L-JETRONIC

System version LH2

General:

The automobile manufacturers are continully demanding extra functions to be carried out by the electronic control unit. For this reason, it has become necessary to further develop the LH1 version of the L-Jetronic.

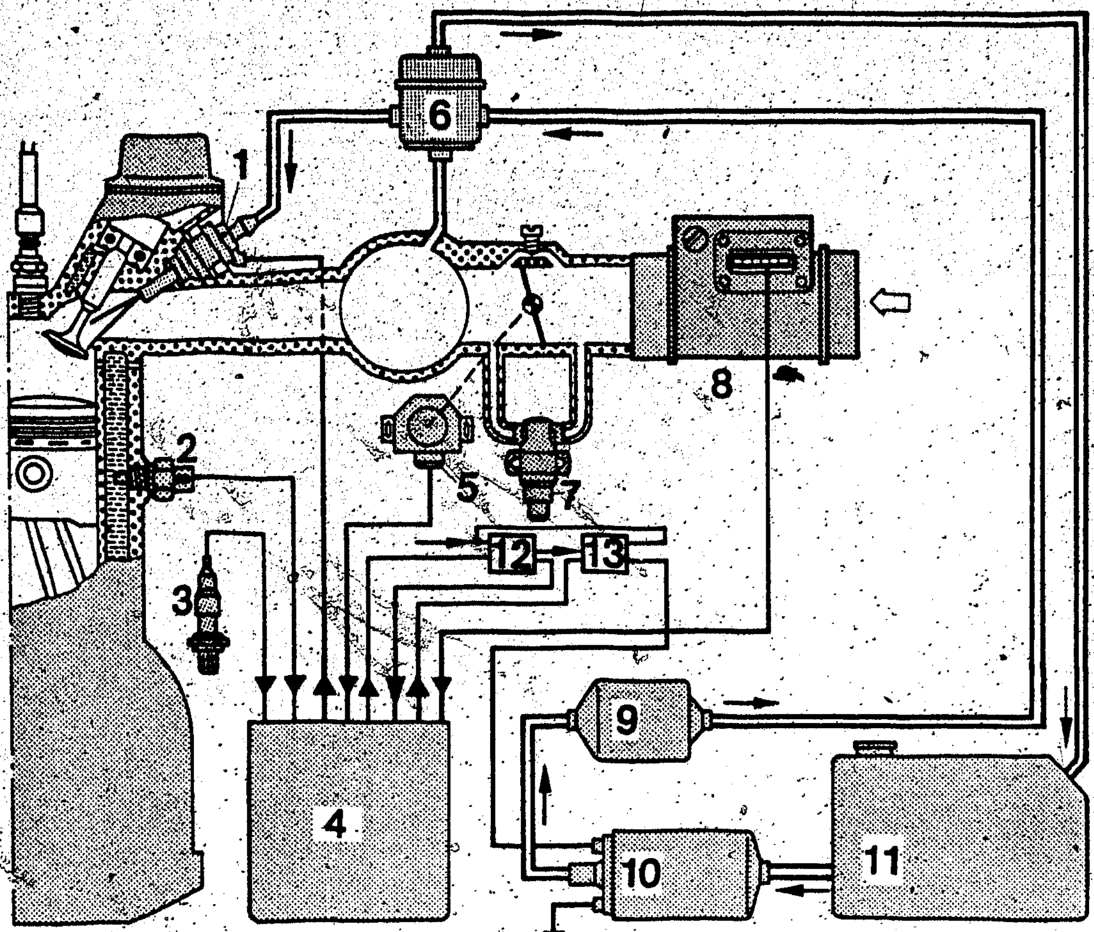
The ever-increasing component density in electronic-circuit engineering has made it possible to accomodate more and more electronic functions in the control unit while at the same time needing less terminals.

The LH2 was developed taking these points intc account.

BOSCH Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung.


C19

## Overall view of LH2 system




1 = Solenoid-operated fuel-injection valve
2 = Temperature sensor II
3 = Lambda sensor
4 = Control unit
5 = Throttle-valve switch
6 = Pressure regulator
7 = Idle actuator
8 = Air-mass sensor
9 = Fuel filter
10 = Electric fuel supply pump
11 = Fuel tank
12 = Main relay
13 = Pump relay

Major differences

| LH2 | LH1 |
|---|---|
| 25-pole electronic control unit | 35-pole electronic control unit |
| Idle-speed control (internal electronic circuitry) | Idle-speed control (internal electronic circuitry) |
| Start control (internal electronic circuitry) | Electrical start valve |
| | Thermo-time switch |
| Both European and US versions possible | Only US version possible |

## Electronic control unit (ECU)

The housing concept was taken over from the L-Jetronic (LE version). The circuitry for the idle-speed control (LFR) was integrated in the control unit. In addition, the LH2 version incorporates a start-control circuit (instead of an electrical start valve and a thermo-time switch). In this respect, refer to VDT-I-280/6 from 10.83.

### Available scope of ECU functions

**Input**

- Air mass
- Rotational speed/trigger
- Engine temperature
- Supply voltage
- Lambda sensor
- Additive advance-map shift
- Idle switch
- Full-load switch
- Start signal (Term. 50)
- Gearbox setting or air-conditioner
- Cancellation of overrun fuel cut-off
- Test pin for idle-speed control
- Ignition switch (Term. 15)
- 2nd engine-speed limiting

**ECU function**

- Start enrichment
- Start control
- Post-start enrichment
- Warm-up enrichment
- Acceleration enrichment
- Lambda map
- Full-load enrichment
- Overrun fuel cut-off
- Engine-speed limitation
- Pulse-time limitation
- Anti-search function
- Lambda closed-loop control
- Idle-speed control
- Burn-off control for hot-wire air-mass sensor
- Limp-home function for hot-wire air-mass sensor
- Additive advance-map shift
- Load-signal processing
- Electric fuel-pump control

**Output**

- Solenoid fuel-injection valves
- Electric fuel-supply pump
- Idle actuator
- Burn-free, hot-wire air-mass sensor
- Indicator lamp for Lambda closed-loop control
- Indicator lamp for limp-home facility
- Load signal $t_q$
- Test output
- Lambda closed-loop control

A large number of ECU functions have already been dealt with in other Technical Bulletins (VDT-I-2801/1, .. 280/4 from 10.83, .. 280/5 from 10.83, .. 280/6, .. 2801/1).

In principle, these functional descriptions are still valid. They have, though, been adapted to new technologies and to different circuitry variations.

The following functions have been added as new:

- Additive advance-map shift (idle CO adjustment)
- Load-signal processing

Additive advance-map shift (a pulse of appropriate length is added to the idle injection pulse):

The CO adjustment is now carried out at the hot-wire air-mass sensor by means of a potentiometer. Adjustments to the potentiometer alter the length of the pulse and with it the duration of injection. This has a direct effect on the CO content of the exhaust gas at idle.
Using this possibility of adjustment, engine differences etc. can be compensated for.
As engine speed rises, the effect of this circuit reduces.

Load-signal processing

This circuit provides a load signal for further processing. This signal can be used, for instance, by trigger boxes as the basis for calculating the ignition point (or ignition angle). The load signal tq contains no other factors (pulses), and in other words is a pure basic injection-pulse signal.

Testability

The universal test adapter with LH2 system adapter cable (1 684 463 141) connected, and multimeter (internal resistance at least 20 kΩ/V), are used to test the electrical/electronic components of the LH2 version i.e.

- Wiring harness
- all components connected to it
- ECU

The system adapter cable described above is a Y-cable to which the ECU is also connected for trouble-shooting. The ECU itself is also tested at the same time.

NEW PRODUCT

VDT-I-280/8 En

L-JETRONIC (VERSION L2)

11.1984

## General

The L2 version is a special development for Volkswagen AG.

It is an electronically controlled, intermittent injection system, similar to the L-Jetronic principle.

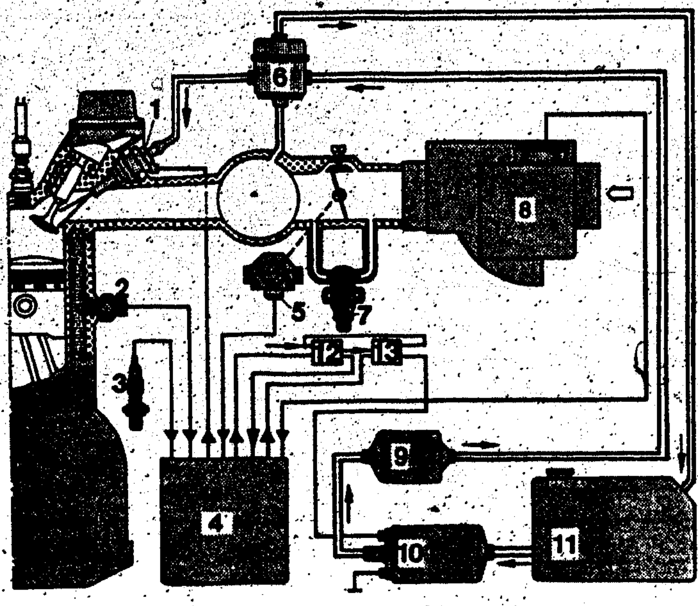
The system has cold-start control, overrun cutoff and idle-speed control (non-Bosch product).

The following components differ from the usual L-Jetronic components:

- Control unit
- Air-flow sensor

Technical Bulletin

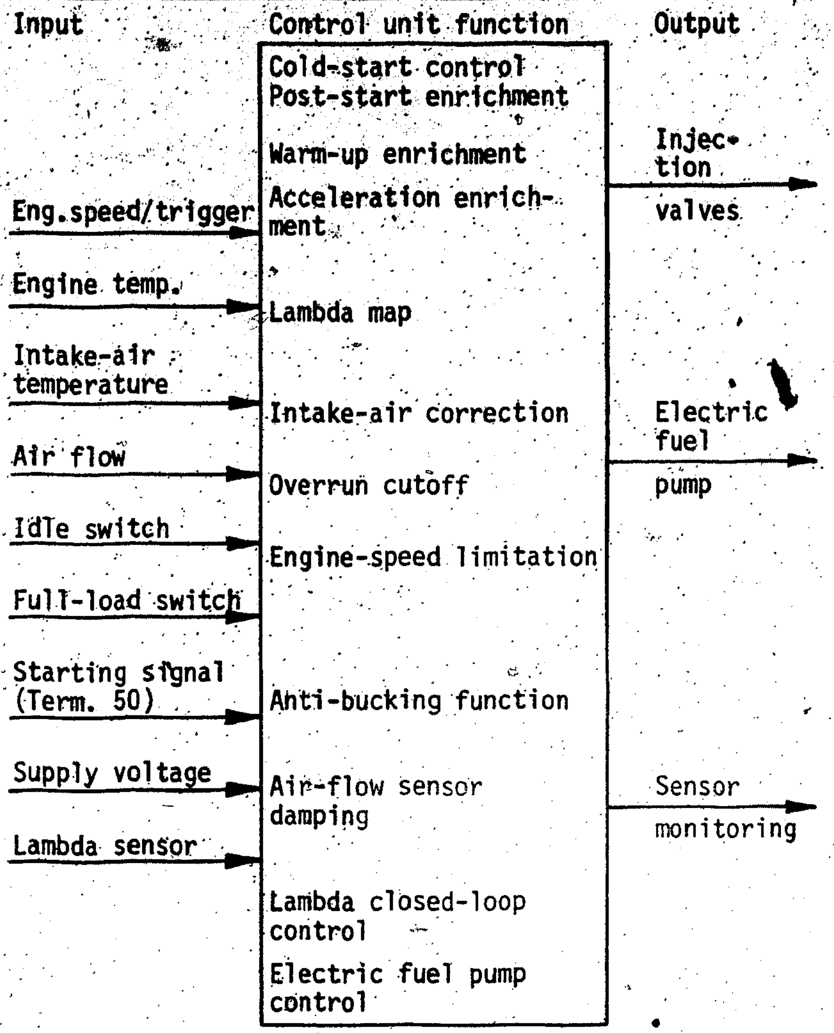
BOSCH Geschäftsbereich KH, Kundendienst Kraftfahrzeug-Ausrüstung.




1 = Solenoid-operated injection valve
2 = Temperature sensor II
3 = Lambda sensor (on US version)
4 = L2 control unit
5 = Throttle-valve switch
6 = Pressure regulator
7 = Idle actuator (non-Bosch product)
8 = Air-flow sensor
9 = Fuel filter
10 = Electric fuel pump
11 = Fuel tank
12 = Main relay
13 = Pump relay

Overall system

## Possible scope of functions of control unit



## Control unit

The design of the housing has been carried over from the L-Jetronic LE version (in future plastic housing). In addition, in the L2 version the thermo-time switch and the start valve have been replaced by the cold-start control function in the control unit. (See also VDT-I-280/6 of 10.83).

The control unit features digital circuitry with a microcomputer.

The optimum calculation of the fuel metering for the respective vehicle model is by means of a map in the control unit.

## Air-flow sensor

The air-flow sensor has retained the same external appearance.

- The output signal of the air-flow sensor corresponds to a single logarithmic characteristic and differs fundamentally from the double logarithmic characteristics used in the L-Jetronic.
- The intake-air temperature sensor is directly measurable at the air-flow sensor connector.
- The L2 air-flow sensor can, thanks to its standard characteristic, be installed in different engine types. The map is adapted to the vehicle exclusively in the control unit.

## Special features

- Overrun cutoff is effective only as of an engine temperature above + 60°C.
- Cold-start control (see VDT-I-280/5 Ed. 2 for operating principle)
- Europe and US version possible.

## Testability

The universal test adapter with special adapter lead is available for testing the L2 version.

The peripherals can be checked in conjunction with a motortester/multimeter.

## Part number

| | |
|---|---|
| Universal test adapter | 0 684 101 801 |
| Adapter lead | 1 684 463 156 |

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

NEW RELAY SET FOR L-JETRONIC — VDT-I-280/104 En

Connection sockets, danger of confusion — 9.1980

New relay combinations 0 332 514 121, ..123, ..124, ..125 and ..127 with black plastic housing are being fitted in L-Jetronic equipped vehicles (e.g. BMW and FIAT).

With these new relay combinations, the two connection sockets can be accidentally confused with one another (for instance during test work). The safeguard pin previously fitted in terminal 88f of the Jetronic wiring harness socket of the relay combination 0 332 514 105 has been omitted and replaced by a "genuine" terminal 88f (see Figs. 1 and 2).

Fig. 1

Layout of the conductors in the connection socket of the relay combination 0 332 514 105 (top view)

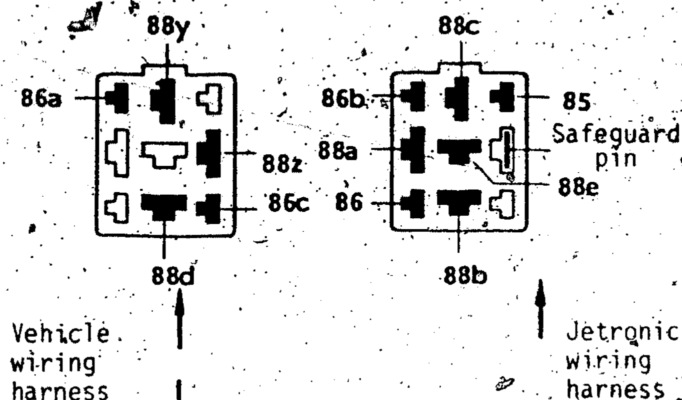
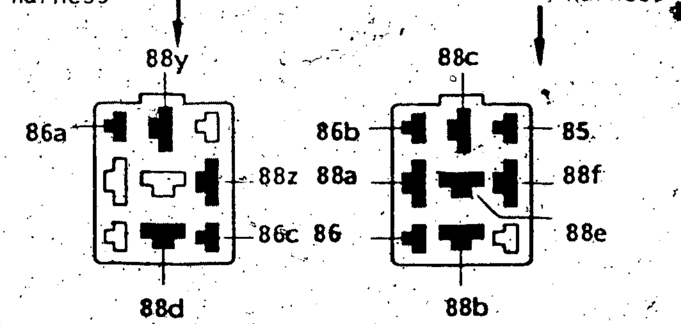



Fig. 2

Layout of the conductors in the connection socket of the relay combinations 0 332 514 121, ..123, ..124, ..125, ..127 (top view)




C28



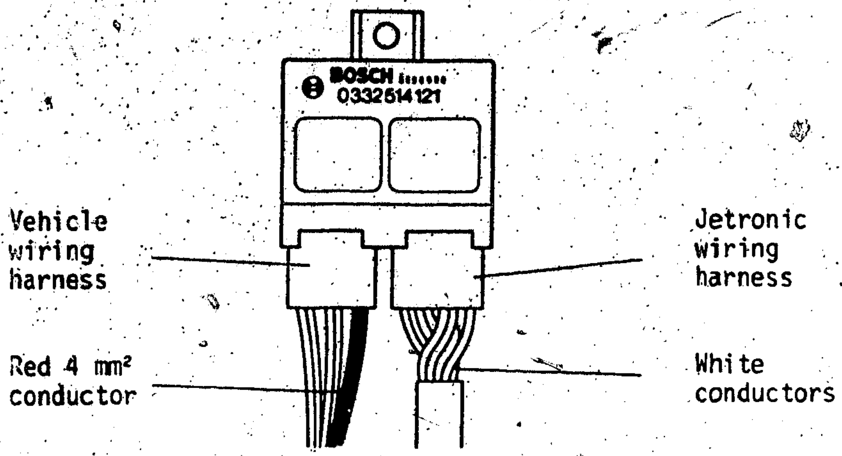
C28-05 26

The connection sockets can also be identified in the following manner:

Vehicle wiring harness - connection socket is recognizable by the thick red conductor (4 mm²) leading to terminal 88Z. As viewed from above it is located on the left of the relay combination (see Fig. 3).

Jetronic wiring harness - connection socket is recognized by the white conductors. As viewed from above it is located on the right of the relay combination (see Fig. 3).

Note: With the wiring-harness sockets interchanged, the electric fuel pump starts to run as soon as the ignition is switched on.




With the introduction of the new relay combination, the resistance value between terminal 86b and 85 changes to 70 ... 500 Ω (L-Jetronic Tester, test step 3.1).

When testing with an ohmmeter, observe correct polarity.

Positive pole of the ohmmeter to terminal 86b.

Register 28
File Identity VDT-I-280/107 En

REPLACEABLE NON-RETURN VALVES

7. 1986

for electric fuel pumps (supersedes Ed. 9. 1984)
0 580 464 ..

| Electric fuel pump | Parts set (non-return valve + seal ring) | Non-return valve | Seal ring |
|---|---|---|---|
| 0 580 364 002 | ----- | 1 583 386 011 | 1 580 203 001 |
| 0 580 453 910 | 1 587 010 509 | | |
| 0 580 464 005 | ----- | 008 | 001 |
| 006 | ----- | 008 | 001 |
| 007 | ----- | 008 | 001 |
| 009 | ----- | 008 | 001 |
| 010 | ----- | 008 | 001 |
| 017 | 1 587 010 002 | | |
| 018 | 007 | | |
| 021 | 006 | | |
| 022 | 007 | | |
| 024 | 006 | | |
| 025 | 007 | | |
| 027 | 006 | | |
| 028 | 006 | | |
| 029 | 506 | | |
| 030 | 006 | | |
| 031 | 005 | | |
| 034 | 1 587 010 508 | | |
| 037 | 006 | | |
| 039 | 007 | | |
| 040 | 516 | | |
| 041 | 517 | | |
| 047 | 006 | | |
| 1 580 464 997 | 1 587 010 006 | | |

For further information on electric fuel pumps see technical-specifications microcard KE 26 and service-parts microcard EE 00 under 0 580 464 ... .

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

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# DETERMINATION OF THE TEMPERATURE VALUES GIVEN IN L-JETRONIC MANUALS

We have recently been asked with increasing regularity how accurately the engine temperature must be measured when trouble-shooting on the vehicle.

So far in its L-Jetronic manuals KH/VSK has given three or four different temperatures for testing the temperature sensor:

-10 °C, +20 °C, +40 °C and +80 °C,

and two ranges for the thermo-time switch e.g. 35 °C 8 sec.

below +30 °C and above +40 °C.

Since the temperature range need not be subject to such close tolerances, we propose in future the following more appropriate definition:

- Ambient temperature (approx. +15 °C to +30 °C)
- Engine at normal operating temperature (approx. +80 °C).

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung.

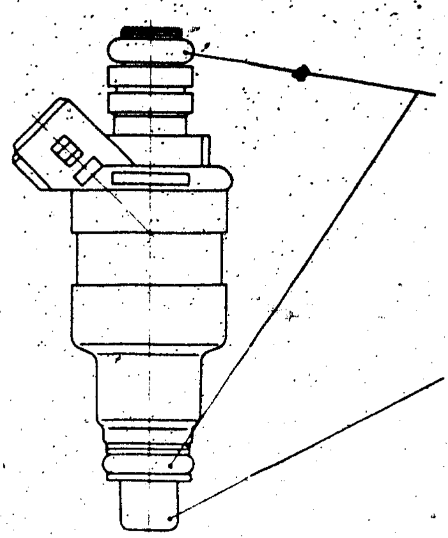

D4

Supersedes 6.1982 edition

## PARTS SET FOR INJECTION VALVES 0 280 150 2.. AND PRESSURE REGULATORS 0 280 160 2..

A common parts set is available for the L-Jetronic/LE-Jetronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve:




Contents for 1 pressure regulator:
1 O-ring
1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.

PLUG CONNECTORS FOR
JETRONIC COMPONENTS
Parts sets

VDT-I-280/111 En
11.1984
(supersedes edition 11.1982)

Parts sets are available for replacement of Jetronic plug connectors. These consist of:

- Plug connector housing
- Protective cap (rubber sleeve)
- Contact springs

These parts are listed on microfiche EE...*.

* see microfiche EE00 under 0 280 ..

- Plug, black, 2-pin,
  parts set 1 287 013 002 cable connector in conjunction with socket, 2-pin

- Socket, black, 2-pin,
  parts set 1 287 013 001 for e.g.:

| | |
|---|---|
| Temperature sensor | 0 280 130 0.. |
| Auxiliary-air device | 0 280 140 .. |
| Thermo-time switch | 0 280 130 2.. |
| Start valve | 0 280 170 .. |
| Warm-up regulator | 0 438 140 .. |

- Socket, grey, 2-pin
  parts set 1 287 013 003 for:

| | |
|---|---|
| Solenoid-operated injection valve | 0 280 150 .. |

Technical Bulletin

BOSCH
Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.

- Socket, black, 3-pin,
  parts set 1 237 000 039 for:

  Throttle-valve switch 0 280 120 ..

- Socket, black, 5-pin,
  parts set 1 287 013 006 for:

  | | |
  |---|---|
  | Air-flow sensor | 0 280 20. .. (LE version) |

- Socket, black, 6-pin,
  parts set 1 287 013 004 for

  | | |
  |---|---|
  | Air-flow sensor | 0 280 200 .. |

- Socket, black, 7-pin,
  parts set 1 287 013 005 for:

  | | |
  |---|---|
  | Air-flow sensor | 0 280 20. .. |
  | Air-mass sensor | 0 280 211 .. |

- Wiring-harness plug connector, black, 25-pin
  parts set 1 287 013 009 for:

  | | |
  |---|---|
  | Control unit | 0 280 0.. |

- Wiring-harness plug connector, black, 35-pin,
  parts set 1 287 013 008 for:

  | | |
  |---|---|
  | Control unit | 0 280 0.. |

The contact springs (minitimers) are also available separately under part no. 1 284 477 026.

The plug-connector housings are only available in the stated colours.

Responsible:
Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)
Please direct questions and comments concerning the contents to our authorized representative in your country.

## Brief description of system

In contrast to the basic version of the L-Jetronic, the LH version measures the air mass instead of the air flow.
The signals are processed in the control unit using digital (and not analog) techniques. The operation of the other components is as in the L versions.

## User

Porsche is equipping its 928 S model (Europe version) with the LH 2 version as of 8.83.

## Components

| | |
|---|---|
| Control unit | 0 280 002 5.. |
| Hot-wire air-mass sensor | 0 280 214 0.. |

Further components as in L version vehicles.

The precise part numbers are listed on the respective vehicle microfiche AA .. .

Technical Bulletin

## Service parts/exchange parts

The control unit will be available as an exchange part one year after the vehicle start-up date (see microfiches WB.. and PD 02).

## Test concept

The system is tested in the vehicle using the universal test adapter in conjunction with a special adapter lead and a commercially available multimeter.
Special tools are not required.

## Test equipment

| | |
|---|---|
| Universal test adapter ETT 018.01 | Part No. 0 684 101 801 |
| Adapter lead | Part No. 1 684 463 141 |

Supplied through usual channels (RG/AV).

## Test equipment hire

The adapter lead can be hired for testing:

In countries outside Germany: From your RG/AV.

## Technical documentation

Technical Bulletin "New Product" VDT-I-280/4 of 10.83 and VDT-I-280/7.
Trouble-shooting instructions and test specifications: SIS microfiche POR 504.

## System training

Integrated in the L-Jetronic course.

## Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period to your national representative for warranty assessment.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments to our authorized representative in your country.

| | |
|---|---|
| L-JETRONIC | VDT-I-280/113 En |
| System version L 2 | 8.1984 |
| After-sales service procedure | supersedes Ed. 12.1983 |

## Brief description of system

In contrast to the L-Jetronic, the L 2 version features the digital processing of the analog input signals of air flow, engine speed and temperature in the control unit by means of a microcomputer.
The construction and operating principle of the overall system are the same as for the L-/LE version.

## User

Volkswagen is equipping the Caravelle Carat bus with the L 2 version as of 10.1983.

## Components

| | |
|---|---|
| Control unit | 0 280 000 5.. (digital) |
| Injection valve | 0 280 150 2.. (brass-wire coil) |

Other components as in L-/LE version.

The precise part numbers are listed on the respective vehicle equipment microfiche AA.. .

Technical Bulletin

BOSCH Geschäftsbereich KH, Kundendienst Kraftfahrzeug-Ausrüstung.


D11

Service parts/exchange parts

The control unit will be available as an exchange part one year after the vehicle start-up date (see microfiches WB 01 and PD 02).

Test concept

The system is tested in the vehicle using the universal test adapter in conjunction with a special adapter lead as well as a commercially available multimeter. Special tools are not required.

Test equipment

Universal test adapter ETT 018.01, Part No. 0 684 101 801
Adapter lead Part No. 1 684 463 156

Supplied through usual channels (RG/AV)

Technical documentation

Technical Bulletin "New Product" VDT-I-280/.. (in preparation).
Trouble-shooting instructions and test specifications: SIS microfiche .. (in preparation)

System training

Special training is not necessary since integrated in L-Jetronic course.

Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period to your national representative for warranty assessment.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

# CODING OF LE/LH-JETRONIC SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En
5.1982

With the introduction of the LE/LH-Jetronic the internal resistance of the solenoid-operated injection valves has also been changed.

Injection valve

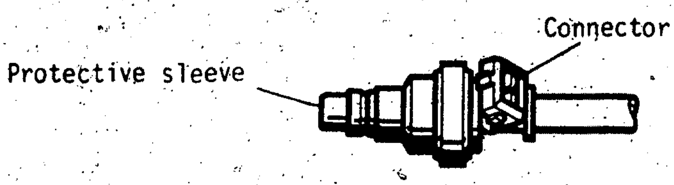
| L-Jetronic | LE/LH-Jetronic |
|---|---|
| 2.5 Ω at + 20°C | 16.2 Ω at + 20°C |

The connector has been left the same for cost reasons and to meet customer wishes.

Caution!
If L-Jetronic injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the injection valves will suffer irreparable damage.

Note:

- Install only injection valves with the part number designated for the vehicle.
- As a guide, injection valves with 16.2 Ω internal resistance have a yellow protective sleeve.




- A colour coding (yellow) of the connector (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic injection valves.

Please direct questions and comments concerning the contents to our authorized representative in your country.

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# Packaging of goods under warranty



D- and L-Jetronic (EFI-D and EFI-L)

VDT-I-280/101 B
10. 1976

All components or assemblies of the D- and L-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those D- and L-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

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Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung

ELECTRIC FUEL PUMPS
FOR D-/L-JETRONIC 0 580 46...
Comparison list of replacement models

VDT-I-280/114 En
6.1985

Several electric fuel pumps for D-/L-Jetronic can be replaced with preferred models by the after-sales service.

In some cases, slight modifications to the electrical connections of the vehicle wiring harness are necessary, e.g. change from cable lugs for M4/M5 stud connections to blade receptacles 7.7 mm/6.3 mm.

The necessary blade receptacles/cable lugs are not included in the scope of delivery of the preferred electric fuel pumps.

Technical Bulletin

BOSCH
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D16

| Preferred model | Can replace | Electrical connections | |
|---|---|---|---|
| 0 580 463 014 | --- | Blade terminal | 7.7/6.3 mm |
| | .. 010 | Blade terminal | 6.3/6.3 mm |
| | .. 012 | Blade terminal | 6.3/6.3 mm |
| | .. 013 | Blade terminal | 6.3/5.0 mm |
| 0 580 464 023 | --- | Thread | M4 / M5 |
| | .. 008 | Blade terminal | 7.7/6.3 mm |
| | .. 013 | Thread | M4 / M5 |
| | .. 015 | Blade terminal | 7.7/6.3 mm |
| | .. 019 | Blade terminal | 7.7/6.3 mm |
| | .. 020 | Thread | M4 / M5 |
| 0 580 464 027 | --- | Thread | M4 / M5 |
| | .. 021 | Thread | M4 / M5 |
| | .. 024 | Blade terminal | 7.7/6.3 mm |
| 0 580 464 025 | --- | Pin terminal | 3.56 mm ø |
| | .. 022 | in mandrel with sealing cap | |

Further information on microcard KE - 26.

Published by:

ROBERT BOSCH GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

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MOBILE AND BUILT-IN RADIO TRANSMITTERS IN VEHICLES WITH L-/LE-JETRONIC
Effect on engine operation and corrective corrective actions

VDT-I-280/106 En
9.1984
(Replaces Ed. 4.1981)

If problems occur in driving (engine shakes, cuts out, etc.) in vehicles equipped with the L-Lor LE-Jetronic in which permanently installed or mobile radio transmitters are being operated, the following actions can be taken to correct such problems:

- Bridge over the hinges on the engine hood and the trunk compartment cover using a flexible copper grounding tape (good ground connection!).
- Ground the base of the aerial neatly to the chassis using a copper grounding tape.
- Locate the radio aerial and the transmitter as far as possible away from the Jetronic control unit in the vehicle.
- Match the transmitter to the radio aerial with as small a reflection coefficient as possible.
- Avoid routing the cable for the transmitter power supply and the aerial parallel to the Jetronic wiring harness (risk of coupling and cross-talk).

Technical Bulletin

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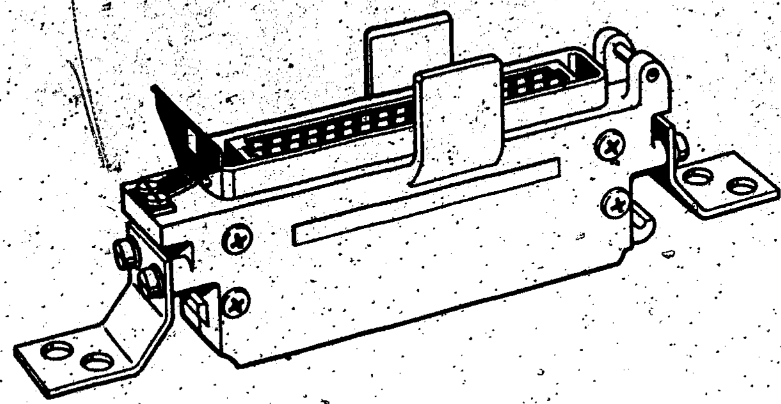
D18



Suppression connector D 280 208 091 (L-Jetronic)
Suppression connector D 280 208 280 (LE-Jetronic)
similar in appearance.

If problems persist in spite of the corrective actions above, the degree of interference suppression can be further improved by inserting the suppression connector D 280 208 091 (L-Jetronic) or D 280 208 280 (LE-Jetronic) between the wiring harness plug and the Jetronic control unit.

Ordering

1: Within Federal Republic of Germany: Order the suppression connectors from KH/VKD 2 via Bosch Franchised Wholesaler.

2: Outside Federal Republic of Germany: Authorized representative please order from KH/VKD 2 using order form "DB11".

Prices On request

Issued by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)
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# CORRECTION OF THE IGNITION POINT AND ADDITIONAL MIXTURE ADAPTATION WITH MOTRONIC CONTROL UNITS - WITH THE AID OF THE PC-BOARD SWITCH AND ADJUSTMENT PIN KDMT 0002

VDT-I-Gen. 058 En
4.1983

Since August 1980 Bosch has been supplying Motronic control units containing a PC-board switch which is accessible from outside.

The introduction of this switch means that workshop personnel have the possibility of changing the ignition point and are also provided with an additional mixture adaptation facility. The values for mixture and ignition correction/adaptation are held within relatively tight limits. A correction may only be undertaken when (1) the fuel quality is not sufficient or when (2) the mixture must be adapted despite the fact that all other known measures have been tried (according to after-sales service instructions).
Unnecessary adjustment to the switch though, leads to poor driveability, and particulary to "search" during overrun or to increased fuel consumption, in some cases even to engine damage.
The vehicle-related Service Information bulletins should at all costs be carefully observed. This Service Information bulletin also gives exact details on the adjustment ranges of the switch positions.

## Ignition-point correction

The quality of the gasoline in various countries does not always comply with the standard required for this engine. It is therefore recommended that for journeys in countries where the premium gasoline (super-grade) octane number (research method) is below 98, a correction be carried out to the ignition point by means of the PC-board switch. This applies especially to the Porsche 944.
Details can be found in the vehicle-related Service Information bulletin.

The correction of the ignition point must be made in the "retard" direction and applies across the whole of the ignition point map. The correction prevents the "ping" and "knock" which are dangerous for the engine.

The adjustment of the ignition point leads, inevitably, to an increase in fuel consumption.

For this reason the original setting should be adjusted again after the journey for which such an adjustment was made.

Mixture adjustment

As is already known, the CO-adjustment takes place through the idle-mixture screw in the air-flow sensor. This is still the case and no change has taken place here. The PC-board switch though, apart from changing the ignition point also provides an additional possibility of adjusting the mixture. The PC-board switch is operative over the complete range as opposed to the bypass in the air-flow sensor which is only effective at idle and lower part-load range. For this reason, a change in the mixture using this switch is only justified when it is absolutely certain that defects are not present on the engine (i.e. valves, intake system, exhaust), the fuel-injection system or the ignition.

The Motronic is checked using the after-sales service instructions which have already been issued.
Further details as well as a table with switch positions and relevant operating range can be found in the vehicle-related Service Information bulletin.

Special adjustment pin KDMT 0002 for the PC-board switch (Fig. 2)

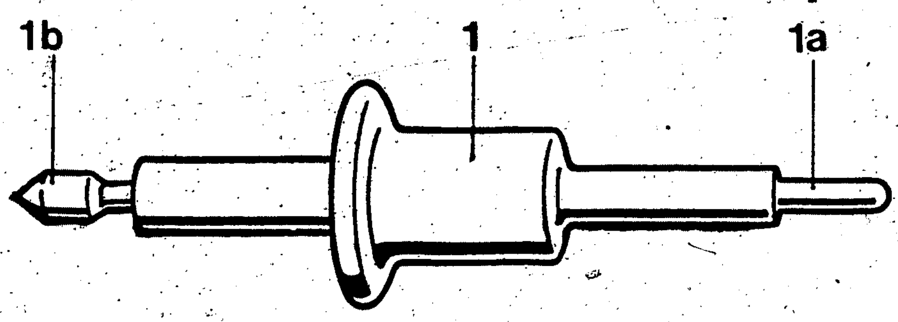
Bosch has developed a special tool for the correct and safe adjustment of the PC-board switch. The tool is made of plastic and prevents damage to the costly control unit when the cover is pressed in and when the switch is pushed up against the stops. When too much force is used, the triangular end of the pin breaks off.

NEVER use a screwdriver to adjust the PC-board switch.

The special tool KDMT 0002 is available through the usual channels or directly from KH/VKD 4. Subscribers to the tool program receive it automatically.

Please note: Tool KDMT 0002 replaces the existing tool KDMT 0001.
KDMT 0002 has a wider range of uses (see below)

Fig. 1




1 = Adjustment pin
1 a = Bore (triangular polygon) for adjusting the PC-board switch,
1 b = Tool part for removing the cover (only for control units with metal housing)

Adjusting the PC-board switch

Remove the control unit (see after-sales service instructions)
At the moment there are two kinds of control unit: with cast frame (former design, Fig. 2) and with metal housing (new design, Fig. 3).

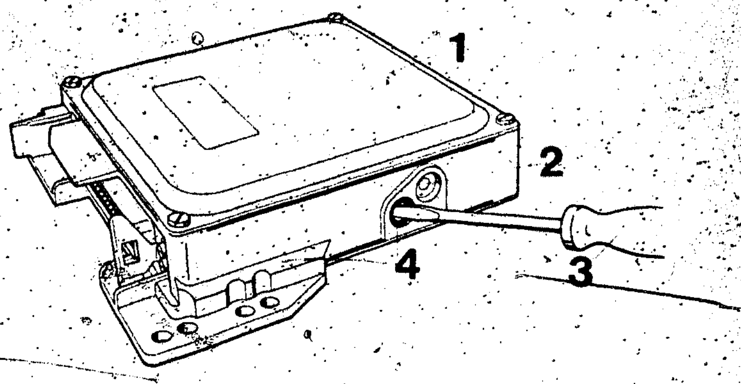
With control units with cast frame (Fig. 2) proceed as follows:

Using a screwdriver, carefully remove the cover.
In order to do this, insert a wide-bladed screwdriver into the side at an angle, carefully push through the cover and remove it (Fig. 2). Take care that the PC-board is not knocked or otherwise contacted in the process.

The hole (triangular polygon) is now free for insertion of the special tool KDMT 0002.

Fig 2

1 = Control unit with cast frame
2 = Diode
3 = Screwdriver
4 = Cover for PC-board switch

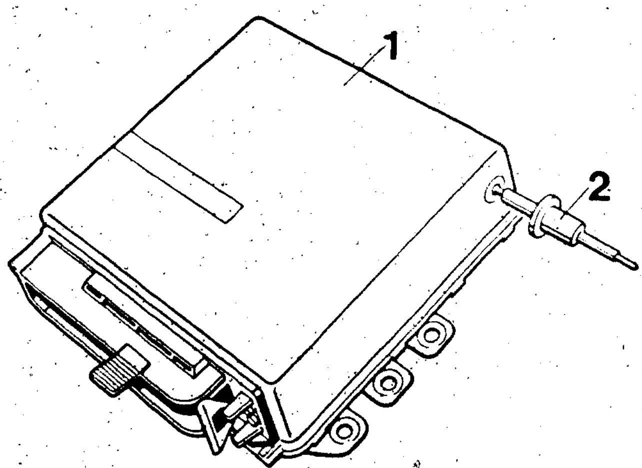



With control units with metal housing (Fig. 3) the cover should be removed as follows:

The point of the adjusting pin intended for removing the cover (Fig. 1, no. 1b) should be inserted fully into the cover (Fig. 3). This loosens the locking device of the cover and enables the latter to be removed. Now the hole is ready (triangular polygon) is ready to receive the bore of KDMT 0002.

Fig. 3

1 = Control unit with metal housing
2 = Adjusting pin KDMT 0002



The following applies for both kinds of control unit:

Due to the danger of destroying the control unit, metallic objects or screwdrivers are NOT to be used, only the special tool KDMT 0002.

Using a minimum of force, turn the PC-board switch to its left-hand stop (Fig. 4). If already adjusted, count the number of "click" positions and note them down.

Select the new switch position according to the vehicle-related table.

Start counting the "click" positions from the left. Take into account the fact that the switch has defined detent positions and intermediate positions are not possible.

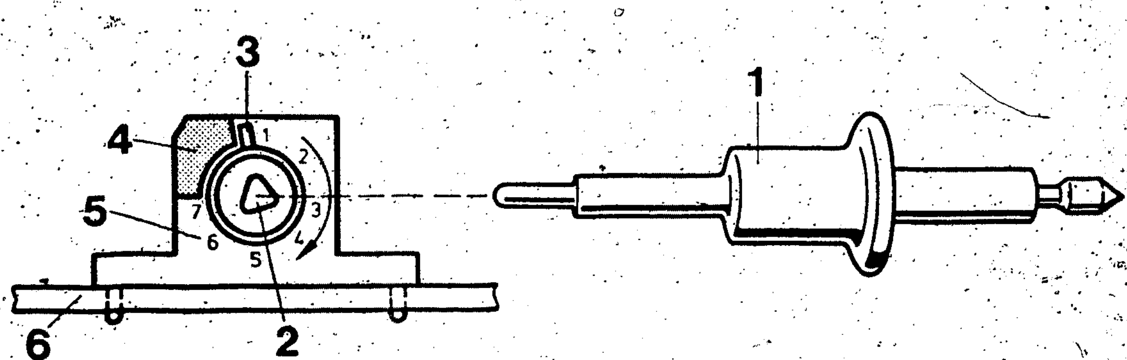
Check that the setting is correct by using the CO-analyzer and by taking the vehicle on a test run.

After the adjustment has been completed, a new cover (red) MUST be fitted in the hole in the control unit. This is important because it guarantees protection against humidity and prevents unauthorized tampering.

Part no. for cover (red) for control unit with cast frame: 1 280 508 012
Part no. for cover (red) for control unit with metal housing : 1 260 321 002

Please note: Black and blue covers are only fitted by Bosch or the vehicle manufacturer at their works.

Fig. 4




1 = Adjusting pin KDMT 0002
2 = Hole (triangular polygon)
3 = Basic position (left-hand stop)
4 = Stop
5 = Switch positions ("click" positions)
6 = PC-board

# Jetronic/Motronic
# Overview of Systems

D24

BOSCH

The following pages give a general overview of the Jetronic and Motronic systems which have been supplied up till now for standard-series vehicles.

Further details on the individual systems are to be found in the Technical Bulletins dealing with the system or in the vehicle-related SIS microfiches.

There are at the moment 4 basic fuel-injection systems:-

- D-Jetronic (no longer produced)
- L-Jetronic
- K-Jetronic
- Motronic

Within the Jetronic/Motronic fuel-injection systems there are in each case several versions of the system, these differing by scope of operation, other specifications for other countries or also by other designs of the control unit or housing.

## Jetronic / Motronic Systems

| Basic systems | Versions of system | Pin connect-ions | Main control factor: Manifold press. | Air quantity | Air mass | Fuel metering: Intermittent | Continuous | Fuel pressure bar | Design: Mech. | Electronic: Analog | Digital | Market: Europe | USA/Japan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-Jetronic | - | 25 | ● | | | ● | | 2,0 | | ● | | ● | ● |
| L-Jetronic | L 1 | 35 | | ● | | ● | | 2,5/3,0 | | ● | | ● | ● |
| | L 2 | 25 | | ● | | ● | | 2,5/3,0 | | | ● | ● | ● |
| | LU | 25 | | ● | | ● | | 2,5/3,0 | | ● | | | ● |
| | LE 1 | 25 | | ● | | ● | | 2,5/3,0 | | ● | | ● | |
| | LE 2 | 25 | | ● | | ● | | 2,5/3,0 | | ● | | ● | |
| | LH 1 | 35 | | | ● | ● | | 2,5/3,0 | | | ● | | ● |
| | LH 2 | 25 | | | ● | ● | | 2,5/3,0 | | | ● | ● | ● |
| K-Jetronic | K | - | | ● | | | ○ | 4,8...5,2 | ● | | | ● | ● |
| | K-λ | 35 od. 25 | | ● | | | ● | 4,8 | ● | ● | | | ● |
| | KE 1 | 25 | | ● | | | ● | 5,4 | ● | ● | | ● | |
| | KE 2 | 25 | | ● | | | ● | 5,4 | ● | ● | ● | ● | ● |
| Motronic | (I.Gen.) | 35 | | ● | | ● | | 2,5/3,0 | | | ● | ● | |
| | ML 1 (II.Gen.) | 35 | | ● | | ● | | 2,5/3,0 | | | ● | ● | ● |
| | ML 2 (II.Gen.) | 35 | | ● | | ● | | 2,5/3,0 | | | ● | ● | |
| | MG | 2x35 | | ● | | ● | | 2,5/3,0 | | | ● | ● | |
| | ML 3 | 35 | | ● | | ● | | 2,5/3,0 | | | ● | ● | ● |

| …et USA/Japan | Series as from | Special control unit function: Lambda map | Lambda closed-loop | Idle-speed control | Overrun cutoff | Electronic ignit. adjustment | Adapter cable for universal test adapter 0 684 101 .. ETT 018.01 | Remarks |
|---|---|---|---|---|---|---|---|---|
| ● | 1967 | | | | ● | | – | Replaced by L-Jetronic |
| ● | 1973 | | ● | | ● | | ...129 | Electronically controlled, driveless system with intermittent fuel injection |
| ● | 1983 | ● | ● | | ● | | in preparation | Special design L-Jetronic with digital control unit and air-flow sensor |
| ● | 1982 | | ● | | ● | | ...123 | Economical system for US market, similar to LE 1 but with Lambda closed-loop control |
| | 1981 | | | | ● | | ...123 | Economical system for European market |
| | 1982 | | | | ● | | ...123 | Like LE 1 but with start control (no thermo-time switch or start valve) |
| ● | 1981 | | ● | | ● | | – | 1st. generation of L-Jetronic (LH). Hot-wire air mass sensor instead of air-flow sensor |
| ● | 1982 | ● | ● | ● | ● | | ...141 | Like LH 1, but with improved circuitry (higher integration) |
| ● | 1973 | | | | | | – | Mechanical driveless system with continuous fuel injection |
| ● | 1976 | | ● | | | | – | K-Jetronic including Lambda closed-loop control |
| | 1982 | | | | ● | | ...135 | K-Jetronic with electrical control of all correction functions |
| ● | 1983 | | ● | ● | ● | | ...135 | Like KE 1 but with idle speed control and optionally with Lambda control |
| | 1979 | | | | ● | ● | ETT 018.00 | Ignition and fuel injection in one control unit with ignition map |
| ● | 1981 | ● | ● | | ● | ● | ...124 ...128 | New terminal allocation, US design with Lambda control, metal housing |
| | 1982 | ● | | | ● | ● | ...124 | New housing, economical |
| | 1983 | ● | | | ● | ● | ...124 ...140 | Motronic and electronic transmission control in one control unit |
| ● | 1983 | ● | ● | ● | ● | ● | ...124 ...128 | Economical with extended scope of system |

## 1. Application

The multiplicity of different fuel-injection and ignition systems at present available on the market, as well as the advances in development which can be expected in the future, demand a new testing concept. In order to maintain the outlay for test equipment, and hence the costs, at a reasonable limit we have developed the universal test adapter.

The following systems can be tested using a test-adapter universal unit together with adapter leads suited to the system in question:

### 1.1 Systems which are already being fitted as series:

- L-Jetronic (1st generation)
- LE-Jetronic (2nd-generation L-Jetronic)
- Motronic (with the new connector designation, refer to the vehicle-specific instructions!)

### 1.2 Systems whose introduction is planned:

- Motronic with gearbox control
- KE-Jetronic
- Mono-Jetronic
- Electronic ignition system with ignition map (EZF)

## 2. Delivery dates and Part Numbers

Available as from 2.1982.

### 2.1 Universal test adapter (basic unit)

Part Number: 0 684 101 801

Designation: ETT 018.01

### 2.2 System adapter lead for LE-Jetronic (2nd-generation L-Jetronic)

Part Number 1 684 463 123

First application: For BMW 2.5/2.8 l engines as from 9.1981, and for Opel 2.0 l engines (Manta/Rekord) as from 9.1981.

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## 2.3 System adapter lead for Motronic with new connector assignment.

(Refer to the vehicle-related instructions!)

Part Number : 1 684 463 124
First application: Porsche 944 as from series production, BMW as from about 3.1982 (Europe)

## 2.4 System adapter lead for L-Jetronic (in preparation)

Further system adapter leads will be made available along with the introduction of the new systems as mentioned above.

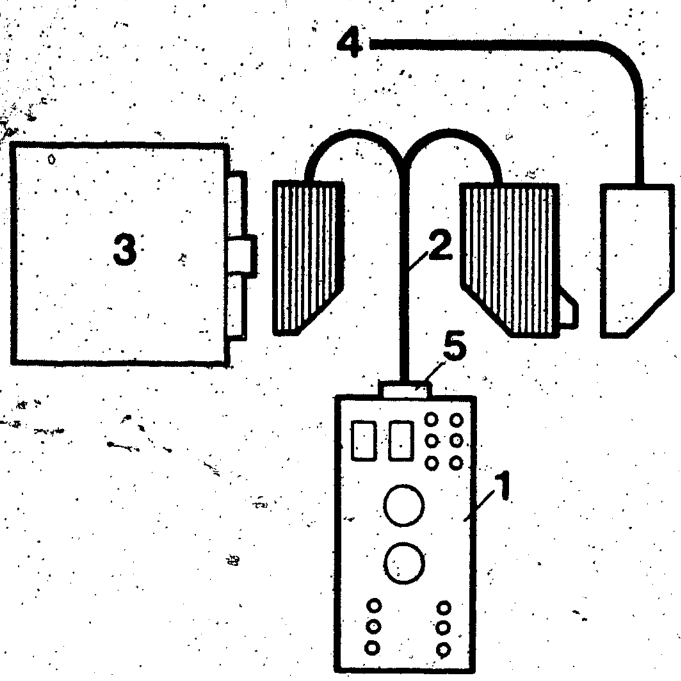
## 3. Testing procedure

The systems and the components are tested for voltage and resistance values as well as for correct functioning. Evaluation is by means of a multimeter and the Motortester which are connected into the universal test adapter.

Depending upon the complexity of the system, interchangeable adapter lead model 1 or model 2 is provided:

## 3.1 Adapter lead for peripheral and function testing (Model 1)

The universal test adapter together with the system adapter lead is to be connected to the system wiring harness and to the control unit (e.g. Motronic).
To be tested: Wiring harness with components and control unit.



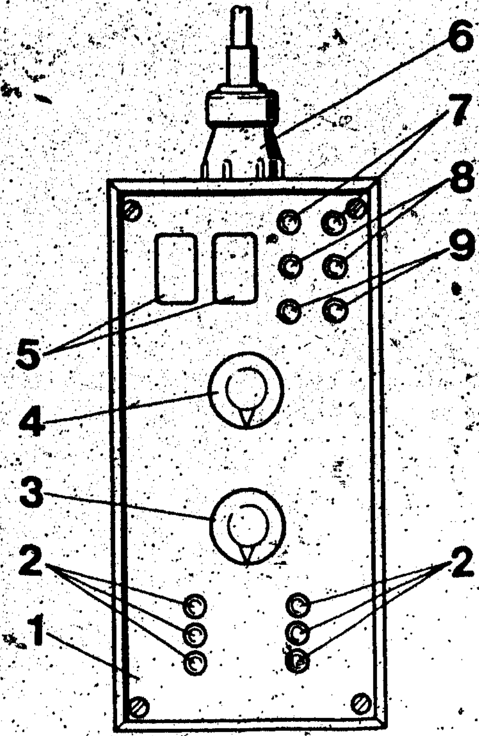

1 = Universal test adapter (basic unit)

2 = System adapter lead (Y-version)

3 = Control unit

4 = System wiring harness

5 = Plug connection




1 = Universal test adapter (basic unit)

2 = Keyboard for simulation of various conditions e.g. engine temperature, throttle position etc.

3 = Program switch "Ohm" for resistance measurement

4 = Program switch "Volt" for voltage measurement

5 = Measurement "cavities" (for the special input from the Motortester)

6 = 63-pole plug-in connection for connecting the system adapter lead

7 = Measurement sockets (voltage measurement with a multimeter or with the Motortester)

8 = Measurement sockets (resistance measurement with the multimeter)

9 = Sockets for special functions (not yet allocated)

Notes:

1. The Motronic test adapter (0 684 101 800, ETT 018.00) will continue to be used for Motronic-equipped BMW vehicles (with old connector assignment) up to about year of manufacture 3.1982 (refer to vehicle-specific instructions).

2. Details on the operation of the universal test adapter, and the test specs, are to be found in the vehicle-specific after-sales service instructions.

3. Caution! Change of Part Number:

On the SIS-microfiches OPE-00/J22 (Coordinates A14 and A17) the new Part Numbers are as follows:

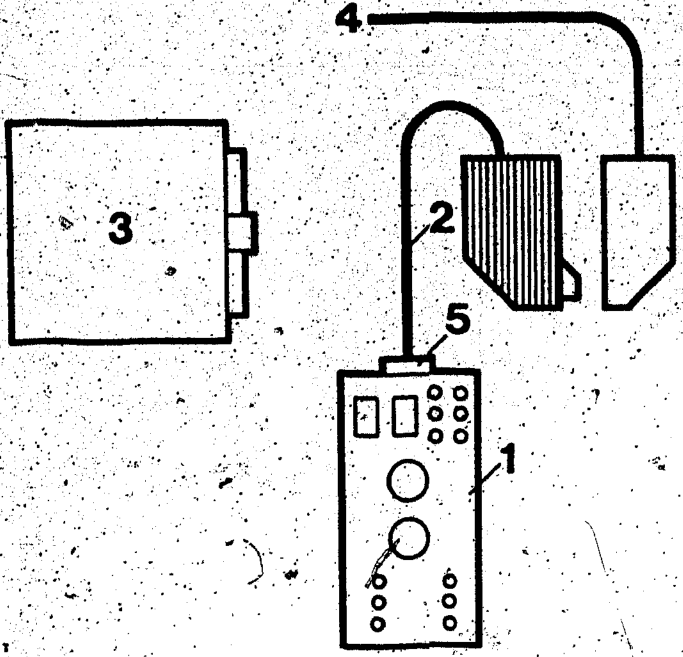
Universal test adapter: 0 684 101 801

Adapter lead : 1 684 463 123

## 3.2 Adapter lead for peripheral testing (Model 2)

The universal test adapter with system adapter lead, is only to be connected to the system wiring harness (e.g. LE-Jetronic (2nd-generation L-Jetronic)).

To be tested: Wiring harness with components (without control unit).




1 = Universal test adapter (basic unit)

2 = System adapter lead

3 = Control unit (not connected)

4 = System wiring harness

5 = Plug connection

## 4. Construction of the universal test adapters

The universal test adapter is fitted with 2 program switches fooltage and resistance measurement. The measured values are displayed on the multimeter connected to the universal test adapter. For reasons of safety, the voltage and resistance sockets are separated. In order to measure signals (e.g. injection pulses, ignition pulses), it is necessary to connect a Motortester to the measuring cavities (special input).

When carrying out functional tests with the control unit connected, selected push-buttons are pressed in a number of test-program steps in order to simulate a variety of different engine operating conditions the influence of which is evaluated using the Motortester.

# DIAGNOSIS IN CASE OF DEPOSITS ON SOLENOID-OPERATED INJECTION VALVES

Impurities in the fuel result in the formation of deposits at the metering gap on solenoid-operated injection valves. These deposits have the effect of "leaning" the mixture, i.e. the cylinder in question is supplied with too little fuel.

The following fault symptoms point to the above-mentioned problem:

* Idle CO cannot be adjusted
  (CO concentration is too low)
* Rough idling
* Part-load bucking
* Backfiring in intake manifold
* No maximum engine power
* Flat spot on acceleration and delay in throttle take-up
* Engine bucking on warm-up
* Engine stalling when declutching after overrun.

If more than one of the above-mentioned symptoms are suspected simultaneously, it is advantageous in this particular case when checking the system not, for reasons of time and as otherwise usual, to perform the complete trouble-shooting, but to assess the solenoid-operated injection valves by way of the engine idle speed (only on 4- and 6-cylinder engines). To do this, it is practical to check the solenoid-operated injection valves mechanically and hydraulically as follows:

Conditions:

* No leaking on air-intake system.

* With electronic-ignition systems, the ignition timing must be kept constant while testing (e.g. basic setting). For BOSCH systems, see information on appropriate SIS microcard. For other-make systems, see OEM documentation.

* Disable idle-speed control (if fitted) (pinch off hose from idle actuator) or render system inoperative electrically.
  For BOSCH systems, see information on appropriate SIS microcard.
  For other-make systems, see OEM documentation.

* Shut down other-make systems, such as digital idle stabilization (by jumping electrically).

Let the warmed-up engine (+ 80° C) run.

Testing:

Disconnect injection-valve connectors individually, one after the other, from the injection valves and plug on again.

The engine-idle speed must:

1. Remain virtually constant if there are deposits on an injection valve.

2. Drop noticeably in the case of an injection valve without deposits.

When testing, wait until the engine speed is constant. Replace injection valve that has deposits (billing through warranty not possible).

On the basis of the test, have deposits been found on the injection valves and have these been replaced?

Yes: After careful installation, it is necessary:

1. To check the system for leaks on the fuel and air sides and, if necessary, to perform repairs.

2. To adjust the CO concentration and idle speed in accordance with SIS microcard data.

No: If the injection valves are O.K., rectify the fault in accordance with the corresponding SIS microcard.

Recommendation:

Use quality fuel only!
Additives in the fuel counteract deposits on the injection valves.

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Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

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LAMBDA SENSORS 0 258 00.. ... Replaces edition 05.1985 (I-Gen. 072)

Cross-reference of original-equipment sensors with workshop replacements

KH supplies two lambda sensors for replacement requirements at Bosch Service Workshops. These two sensors replace an entire series of original-equipment sensors.

Both sensors have crimp connections to which the original cable (with original plug) is connected (detailed mounting instructions are supplied with each sensor).

| Original-equipment type | Workshop replacement |
| --- | --- |
| 0 258 001 001 | 0 258 001 027 |
| 003 | 025 |
| 004 | 027 |
| 005 | 027 |
| 006 | 027 |
| 007 | 025 |
| 008 | 025 |
| 009 | 025 |
| 010 | 027 |
| 011 | 025 |
| 012 | 027 |
| 0 258 001 013 | 027 |
| 014 | 027 |
| 015 | 027 |
| 016 | 027 |
| 017 | 025 |
| 018 | 027 |
| 020 | 025 |
| 021 | 027 |

| Original-equipment type | Workshop replacement |
|---|---|
| 0 258 001 022 | 0 258 001 025 |
| 024 | 025 |
| 026 | 027 |
| 028 | 027 |
| 029 | 025 |
| 030 | 027 |
| 031 | 025 |
| 032 | 027 |
| 035 | 027 |
| 037 | 027 |
| 038 | 027 |
| 039 | 025 |
| 040 | 025 |
| 041 | 025 |
| 042 | 025 |
| 043 | 027 |
| 044 | 025 |
| 045 | 025 |
| 046 | 025 |
| 047 | 025 |
| 048 | 025 |
| 051 | 027 |
| 060 | 025 |
| 061 | 025 |
| 062 | 025 |
| 063 | 025 |
| 064 | 025 |
| 0 258 002 001 | 025 |
| 002 | 025 |
| 007 | 025 |
| 008 | 025 |
| 009 | 025 |
| 010 | 025 |
| 011 | 025 |
| 012 | 025 |
| 014 | 025 |
| 015 | 025 |

Responsible:
ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)
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LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC



Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

## Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

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ELECTRONIC IDLE-CHARGE CLOSED-LOOP CONTROL
for spark-ignition engines (Volvo, USA models as from model year 1981)

VDT-I-2801/1 En
12.1980

Engine wear and fouling of the intake passages lead to the fact that the idle speed changes during the course of the service life of an engine.

This change in speed can normally be corrected by turning an adjusting screw (bypass screw on vehicles fitted with a Jetronic system).

Future USA legislation will prohibit this practice. This results in the need to regulate the engine automatically to a constant idle speed.

Such a method of closed-loop control can be implemented by changing the mixture composition (changing the air-fuel ratio), by changing the ignition timing, or by changing the charge (volume of mixture).

However, the first two of these possibilities are problematical since, under certain circumstances, there may be an adverse effect on exhaust-gas emissions and the timing range may be limited.

The third possibility, that of regulating the mixture charge to the cylinders, does not have these disadvantages. This is why it was incorporated in the new Bosch system.

Idle-charge closed-loop control provides further advantages apart from the initially mentioned compliance with legal requirements.

It is possible in this way to guarantee an idle-speed performance which is constant under all conditions and which is favourable in terms of emissions and fuel economy.

Idle-charge closed-loop control makes it possible to achieve considerably lower idle speeds than in the same engines without this facility. Drops in engine speed when loads are switched on, e.g. steering booster, drive mode in automatic transmissions, air conditioner etc, are prevented.

The Bosch idle-charge closed-loop control will be fitted as standard from the middle of 1980 in USA 4- and 6-cylinder models equipped with K-Jetronic. It is, however, an independent system and is not bound to any one Jetronic system.

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## Construction and principle

The idle-charge closed-loop control consists of the following components:

1 - Control unit
2 - Actuator
3 - Throttle-valve switch
4 - Temperature sensor (engine temperature)

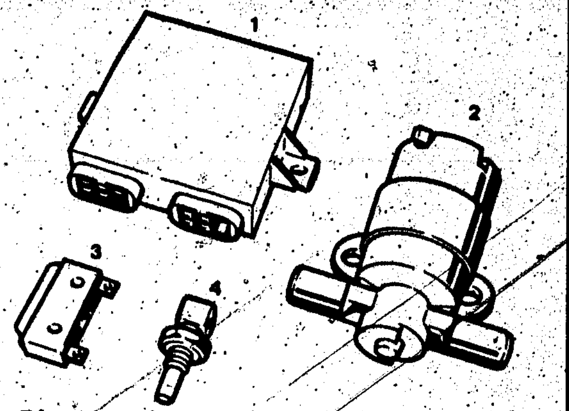


Fig. 1: Components of the idle-charge closed-loop control

The actuator is installed in the throttle-valve bypass line in place of an auxiliary-air device and determines the idle speed of the engine by means of its open cross-section. The actuator is a double-wound rotary positioner with a limited angle of rotation (approx. 90°).

A rotary slider mounted on the armature shaft opens the air-bypass channel so that the engine is regulated to the desired idle speed irrespective of the load on it.

The desired idle speed is regulated by the control unit which receives the necessary information on the actual engine speed from the ignition system.

However, the control unit is designed in such a way that, depending on the version of engine, the minimum open cross-section of the actuator is electrically limited so that generally it cannot close entirely.

With the warm engine at idle the open cross-section of the actuator is near to the lower electrical limit. Further inputs to the control unit, such as temperature sensor and throttle-valve switch, ensure that malfunctions are prevented even under special conditions, such as low temperatures and changes in engine speed as a result of the accelerator being depressed.

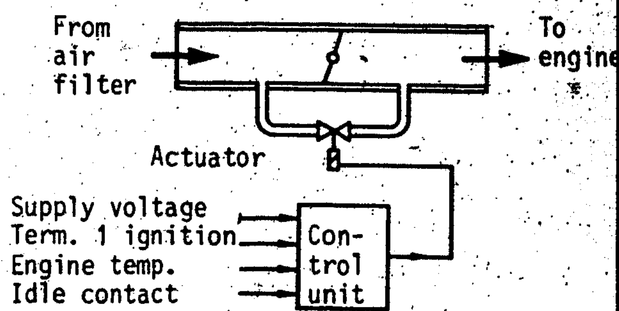


Fig. 2: Principle

## Operation of control unit and actuator

The actuator is triggered from the control unit which is supplied with information on the actual engine speed from the ignition system (terminal 1).

The incoming pulses are converted in the control unit into a voltage signal which is compared with a voltage corresponding to the desired engine speed.

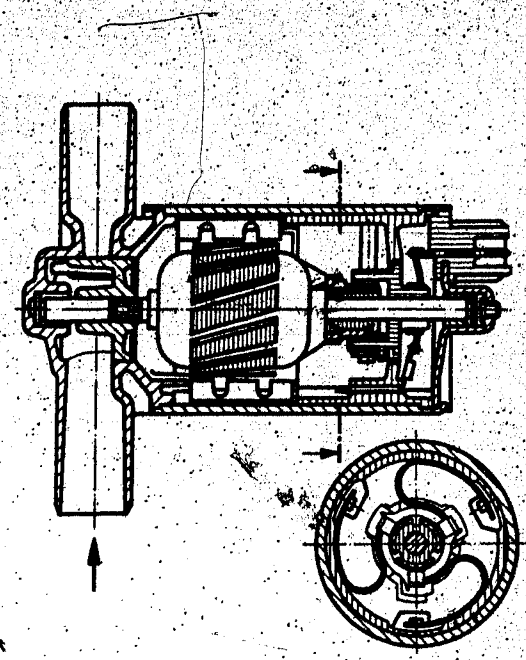

Fig. 3: Section through actuator

The control unit uses the voltage difference to form the trigger signal which is supplied to the actuator as a 100 Hz pulse sequence.

The two windings of the actuator are alternately supplied with voltage during each cycle and cause opposing forces at the armature. The inertia of the armature thus results in a defined angular setting of the rotary slider corresponding to the on-off ratio of the voltage applied.

The on-off ratio range within which the open cross-section can be varied lies between approx. 18% (rotary slider closed) and approx. 82% (rotary slider completely open). These are limit values set by the actuator.

Regulation to the desired idle speed without any additional load on the engine takes place at an on-off ratio of approx. 25%, i.e. with a small open cross-section. Thus, a wide control range is available in the case of high additional loads and for an increase in engine speed during the warm-up phase.

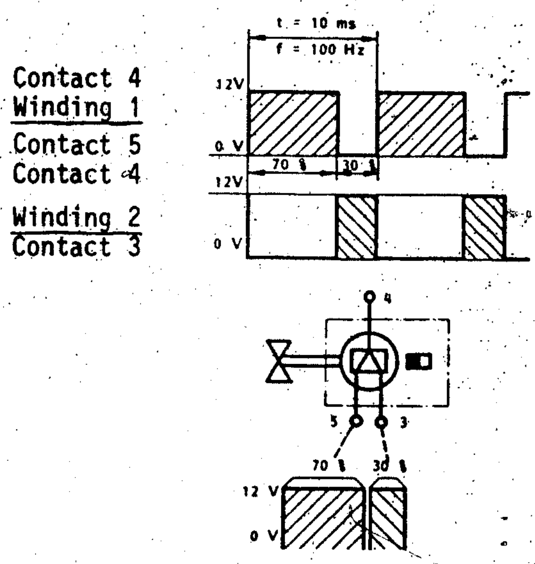


Fig. 4: Triggering of actuator

### Operation of temperature sensor

When cold, the engine has a considerably better throttle take-up if the idle speed is increased as a function of the temperature. For instance, at -20°C this speed must be increased to 1.3 to 1.5 times the speed of the engine when warm, depending on the type of engine. The necessary signal is supplied by the temperature sensor which is installed in the coolant system. As the temperature of the coolant increases, the idle speed is continuously lowered down to the "warm" value.

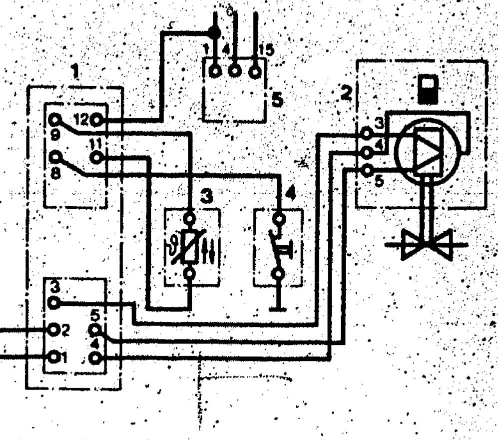


Fig. 5: Electrical circuit diagram

1 = Control unit
2 = Actuator
3 = Temperature sensor
4 = Throttle-valve switch
5 = Ignition coil

### Operation of throttle-valve switch

When the engine speed is increased by the opening of the throttle valve, the control unit attempts to regulate the engine speed to the desired value, i.e. the actuator moves to the electrically limited "closed" end position. This must, however, be prevented since, otherwise, when the throttle valve is closed and additional loads are simultaneously switched on (steering booster, automatic transmission, air conditioner) there would temporarily be a sharp drop in the engine speed.

For this reason, when the throttle valve is open a signal from the throttle-valve switch causes an increase in the minimum open cross-section of the actuator (approx. 10% increase in on-off ratio).

Thus, the speed-regulation process begins with the actuator open, as a result of which a drop in engine speed is prevented.

## Principle of operation, brief description

With the help of the idle-speed control (LFR), it is possible to achieve idle engine performance which remains constant, produces favorable emission figures and is economical in fuel consumption.
Sudden drops in engine speed when e.g. air-conditioning, power steering or the driving position with automatic transmission is switched on, are therefore avoided.

## Users

The first vehicle manufacturer to offer the LFR in Europe is Opel in its Senator/Monza models built after December 1982.

## Components

| | |
|---|---|
| Idle-speed control unit | 0 280 220 .. |
| Idle-speed actuator | 0 280 140 .. |

The part numbers are also listed in the appropriate vehicle-equipment microcard AA.. .

## Service/Exchange parts

The idle-speed control unit (electronic control unit) is available as an exchange item (see exchange microcard WB.. and price list PD 02).

## Test concept

The system is tested in the vehicle using the universal test adapter together with a special system adapter cable and a commercially available multimeter.
Special tools are not necessary.

## Test equipment

Universal test adapter
ETT 018.01 part no. 0 684 101 801
Adapter cable part no. 1 684 463 137

Supplied by RG/AV.

## Lending out of test equipment

The system adapter cable can be loaned out for testing purposes from your RG/AV.

## Technical documentation

Technical Bulletin "New Product" VDT-I-2801/1 En.
Trouble-Shooting Instructions and Test Specifications: in the SIS microcard for the LE-Jetronic: SIS OPE-503.

## Training

Special training is not necessary.

## Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

Components on which a warranty claim is made should be sent during the warranty period to our representative in your country for a warranty verdict.

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E19

# FUEL QUALITY PROBLEMS
## Effects on driveability of vehicles with spark-ignition engines

Fuel grades, which do not comply with DIN standards 51 600 for leaded and 51 607 for unleaded fuels, may have an adverse effect on the starting performance and driveability of fuel-ignition and carburetor vehicles. (Essential: Ignition, mixture-preparation system and engine mechanicals must be O.K.).

| Trouble with vehicle | Possible cause |
|---|---|
| Hot-starting problems (see also VDT-I-Gen. 050) | Vapor locks in fuel due to excess of additional volatile substances (e.g. methanol) |
| Cold-starting problems | Vapor pressure too low with winter fuel |
| Warm-up problems / poor throttle take-up when engine cold | Deposits on inlet valves due to fuel residues and/or carbon residue |

| | |
|---|---|
| Thinning of engine oil, increased engine wear | Residues in combustion chamber due to non-volatile constituents, frequent short-distance driving |
| Carburetor icing | Excess of highly volatile constituents, no anti-icing additive in fuel, intake-air preheating not working |
| Engine knocking | |
| - When accelerating | RON[1] of fuel too low |
| - At high speed | MON[2] of fuel too low |
| increased consumption | Density of fuel too low, Lower calorific value |

1) RON = Research Octane Number

2) MON = Motor Octane Number

Further information on fuels and their properties can be taken from the Bosch "Automotive handbook."

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E21

C13

# POWER-OUTPUT MEASUREMENT ON VEHICLES WITH ALL-WHEEL DRIVE

Measurement of the engine power of all-wheel driven vehicles on roller-type test stands usual in workshops (e.g. LPS 002) is only possible if:

1. the drive train may be split between front-wheel drive and rear-wheel drive,

2. the all-wheel drive can be switched off.

Under no circumstances jack up the vehicle.

Pay particular attention to the owner manual and additional technical information provided by the motor-vehicle manufacturer.

All other vehicles with all-wheel drive, e.g. Golf Synchro, Mercedes Benz 4-matic, BMW 325i X etc., cannot be tested.

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# BOSCH-MOTRONIC®

## A system for the electronic control of fuel injection and ignition.

The **Motronic** (Fig. 1) is the first system to combine, in a digital engine-control system, the functions of fuel injection and ignition. This is computer control for the engine. That is, the application of a microcomputer in the electronic control unit. Up to now, this system has been designated both Digital Electronic Engine Control (DME) and Central Electronics.

The first firm to equip their vehicles with the new Motronic system as original equipment was the BMW Company as from 8. 1979 in their 633 CSi and 732i models.

This important new development is, yet again, another Bosch contribution towards the goals of reducing fuel consumption and pollutant emissions on today's roads.

This is possible, because the Motronic uses a set of ignition curves stored in the microcomputer memory and determines the optimum ignition point for every operating condition. Furthermore, the digital system guarantees long-term constancy of the control of ignition point and injected fuel quantity.

Characteristic for the system is the reduction in wear-and-tear parts in the ignition stage and the common sensors used for both ignition and fuel-injection. These features mean almost complete freedom from maintenance and, in practice, that the mechanical centrifugal and vacuum advance mechanism is no longer required. It also means that a fully electronic breakerless computer ignition with inductive engine-speed sensor and reference-mark sensor can be incorporated in the Motronic system.

On the one hand, the use of a digital control unit makes the system adaptable and versatile (ignition-point map), on the other hand it guarantees unchanging accuracy (long-term constancy) and reproduceability at will of the stored engine data.

All in all, it can be stated with confidence that the Bosch Motronic represents as a complex system a distinct advance in the fields of fuel consumption, exhaust-emission control and economy while at the same time nevertheless improving the driveability, the flexibility of the engine and the freedom from maintenance.

**BOSCH**

Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.


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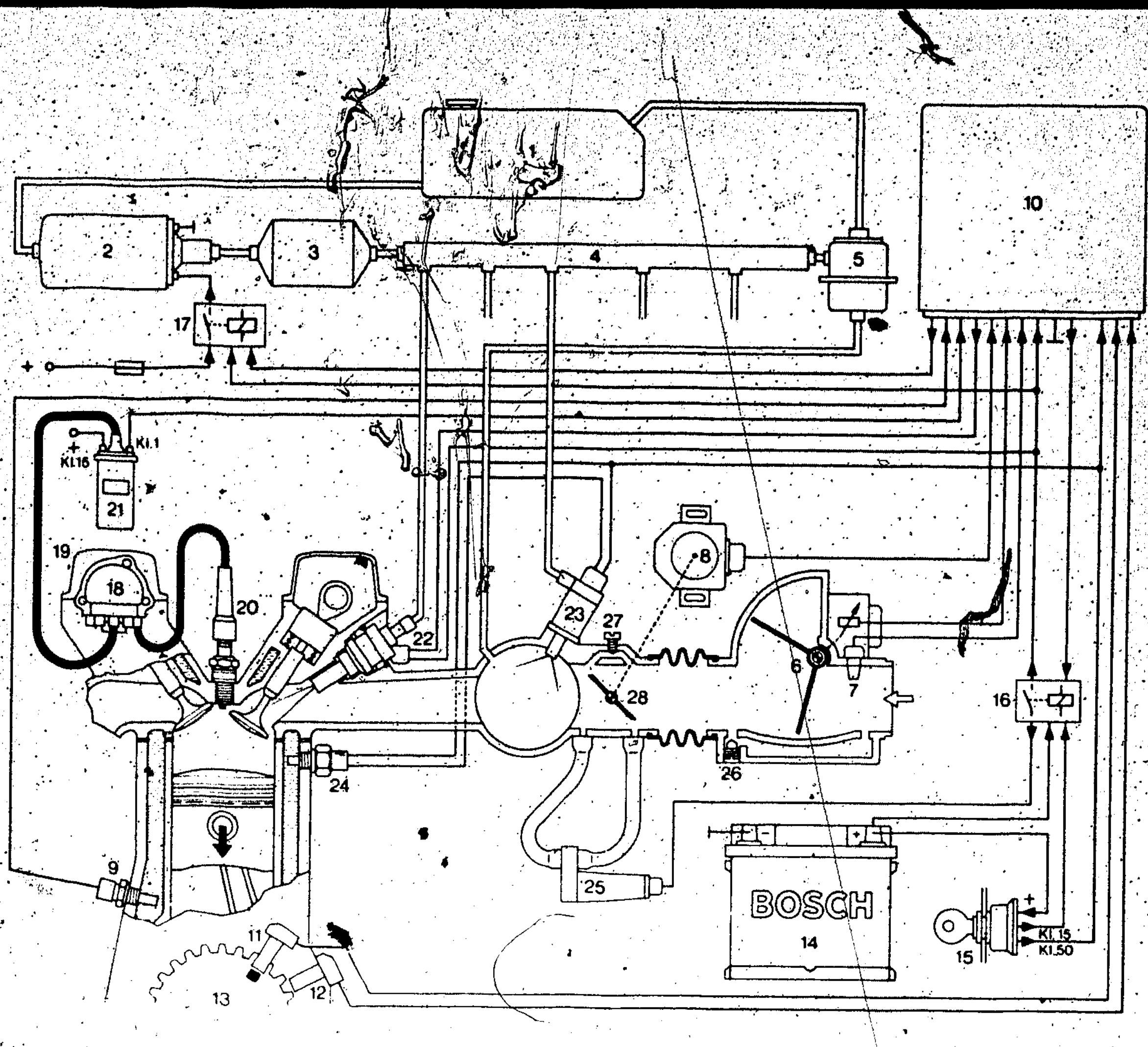


Fig. 1 Motronic-system

## Explanatory notes regarding the system schematic
(Fig. 1)

1 **Fuel tank**

2 **Electric fuel-supply pump**
Delivers the fuel and generates the pressure necessary for injection.

3 **Fuel filter**
Removes the finest impurities from the fuel.

4 **Distributor tube**
Distributes the fuel evenly to each fuel-injection valve.

5 **Pressure regulator**
Maintains the pressure difference constant between the fuel pressure and the manifold pressure.

6 **Air-flow sensor**
Continuously measures the amount of air sucked in by the engine and, via the potentiometer, passes on this information to the control unit in the form of an electrical signal.

7 **Air-temperature sensor**
Reports the temperature of the intake air to the control unit.

8 **Throttle-valve switch**
Reports the operating conditions "idle" and "full-load" to the control unit.

9 **Engine-temperature sensor**
Reports the engine temperature to the control unit.

10 **Control unit**
Processes all engine operating data and the intake-air temperature in order to determine the ignition point, the dwell angle and the amount of fuel which must be injected during the duration of injection.

11 **Reference-mark sensor**
Reports the crankshaft position to the control unit which needs some form of reference to TDC in order to determine the ignition point and the start of injection.

12 **Engine-speed sensor**
Scans the teeth of the flywheel ring gear in order that the control unit can calculate the engine speed.

13 **Flywheel ring gear**

14 **Battery**

15 **Ignition and starting switch**
Connects the vehicle electrical system to the supply voltage and signals the "cranking" process to the control unit. When the engine is cold it switches on the start valve during starting.

16 **Relay 2**
Switches current to the control unit and the fuel-injection valves.

17 **Relay 1**
Switches current to the electric fuel supply pump. It only energizes when relay 2 has operated and the engine is being cranked or is running.

18 **High-voltage distributor**
This is flanged to the engine and allocates the ignition pulses to the cylinders in question. The distributor rotor is fitted directly to the end of the camshaft.

19 **Cylinder head**

20 **Spark plug**

21 **Ignition coil**
Is switched by a transistorized final stage in the control unit.

22 **Fuel-injection valve**
Is switched by a transistorized final stage in the control unit. It is solenoid operated and injects fuel directly before the engine intake valve.

23 **Start valve**
During starting with a cold engine, this injects extra fuel into the intake manifold.

24 **Thermo-time switch**
Limits the switch-on time of the start valve as a function of the engine temperature.

25 **Auxiliary-air device**
Serves to increase and stabilize the engine speed when the engine is cold.

26 **Idle-mixture-adjusting screw**

27 **Idle-speed-adjusting screw**

28 **Throttle valve**

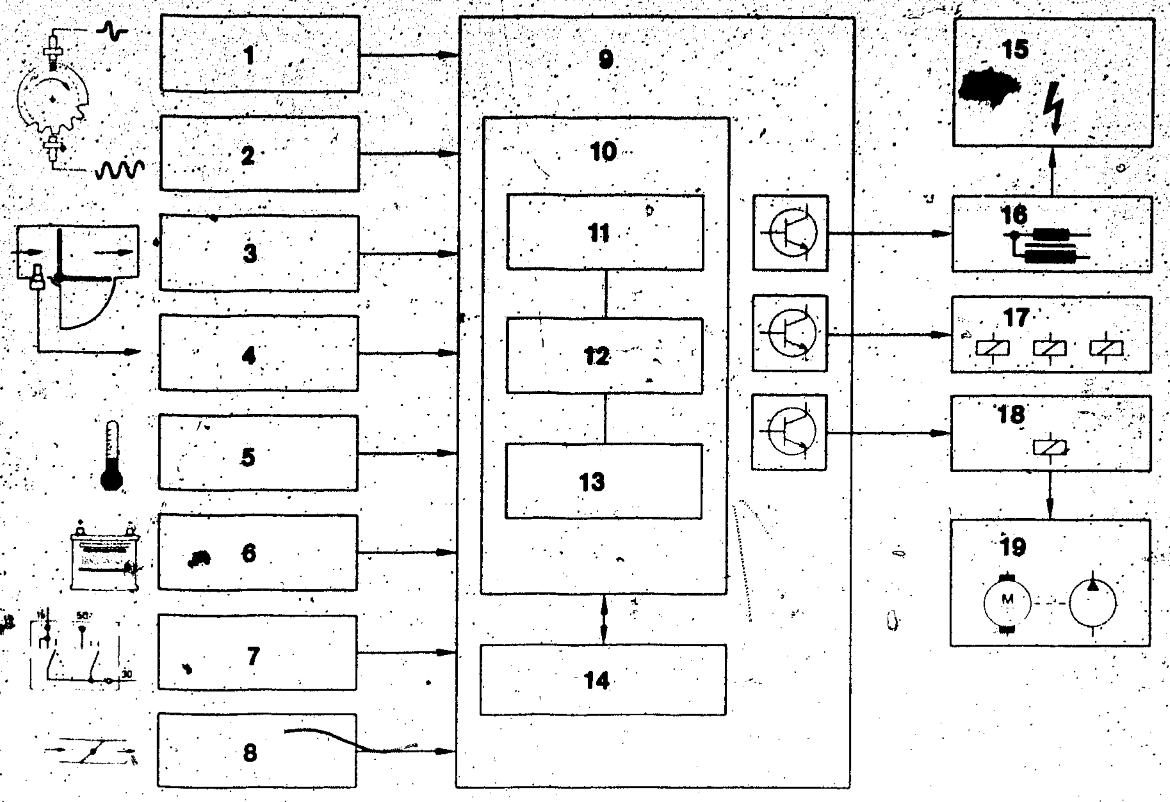


Fig. 2 Motronic block diagram

1 Reference-mark sensor

2 Engine-speed sensor

3 Air-flow sensor (Load sensor)

4 Air temperature

5 Engine temperature

6 Supply voltage

7 Ignition and starting switch

8 Throttle-valve switch (Idle and full-load)

9 **Control unit** Operating as fuel-injection and ignition computer

10 Microcomputer

11 Memory

12 Microprocessor

13 Input and output circuitry

15 Signal processing.

14 High-voltage distributor

16 Ignition coil

17 Fuel-injection valves

18 Pump relay

19 Electric fuel-supply pump

## Operating principle of the Motronic
(Fig. 2)

The system operates with a digital control unit, at the heart of which is a microcomputer. The microcomputer itself contains a microprocessor as its central component.

The control unit receives a multitude of information from the sensors regarding the engine and uses this to determine the optimum ignition point, the most favourable dwell angle and the correct injected fuel quantity for the particular operating conditions of the engine at the instant in question.

Power output stages in the control unit switch the ignition coil and the fuel-injection valves on and off in accordance with the timing calculated by the control unit.

## Correction factors for the ignition

In the case of particular engine operating conditions, certain corrective measures come into effect and modify the "normal" set of ignition curves stored in the memory.
In the following, examples are given of corrections to the ignition point which are dependent upon engine speed and temperature.

**Start phase**
The selection of a particularly favourable ignition point for starting facilitates good hot-starting and cold-starting phases.

**Idle**
When the engine speed falls, the ignition point is shifted in the advance direction. This results in an increase in engine torque, which in turn stabilizes the engine idle speed.

**Overrun**
By adapting the ignition point, perfect combustion is achieved in those cases where an overrun fuel-cutoff is not provided.

**Engine-temperature protection**
In the case of extreme thermal loading as is encountered for instance in city traffic, stop-and-go driving or high outside temperatures, as well as when auxiliary equipment is in operation, a shift of the ignition point in the "advance" direction results in a reduction in engine temperature. The control unit is informed of the critical temperature being approached by means of a temperature sensor which is installed especially for this purpose.

## Sub-system: Fuel-injection

The intermittently operating, electronically controlled fuel-injection system is based on the proven L-Jetronic which has been further developed. An essential difference lies in the processing of the signals which is now carried out digitally in the common control unit.
The engine-speed sensor remains the inductive pick-up on the flywheel ring gear.

The triggering signal for the start of injection through the solenoid-operated fuel-injection valves is orientated to the signal from the reference-mark sensor.

The basic quantity of fuel is calculated by the computer on the basis of the intake air quantity and the engine speed. In doing so, the intake air per piston stroke is calculated and used as the basic signal for the fuel-injection and the ignition curves (load).
In addition to the basic signal, further correction factors must be taken into account for optimum engine operation. These include factors depending upon engine temperature, intake-air temperature and throttle-plate position etc.
A number of correction factors are listed in the following as examples.

**Post-start enrichment and voltage increase** for starting. To guarantee good starting and smooth running of the engine.

**Warm-up enrichment.** Causes enrichment of the air-fuel mixture during the warm-up phase.

**Idle enrichment.** For smooth running of the engine at idle.

**Full-load enrichment** to utilize the engine's maximum torque.

**Altitude compensation (atmospheric-density compensation)** by means of intake-air-temperature sensor.

**Acceleration enrichment** for powerful acceleration. Here, the throttle-plate movement in the air-flow sensor is evaluated.

**Anti-search circuit.** This ensures smooth transition when the load is changed. The control unit recognizes this state by means of the jumps in the engine speed.

**Engine-speed limitation.** Prevents dangerous overrevving of the engine by means of suppressing injection pulses.

**Fuel-shutoff during overrun.** This shuts off the supply of fuel in the overrun mode, and thus saves fuel.

**Fuel-supply pump control**
For reasons of safety, the supply pump must not deliver fuel when the ignition is switched on but the engine is not running. For this reason, the supply pump only operates during the starting process or when the engine is running.
The externally mounted pump relay is controlled by a power transistor in the control unit.

## Sub-system: Ignition

Instead of the mechanical centrifugal and vacuum advance mechanism in the ignition distributor, Motronic employs an ignition-curve "map" which is stored in the control unit. This ignition-curve "map" is vastly superior to the conventional spark-advance methods used up to now and is adapted to all possible operating conditions of the engine.

Due to these new facts, the ignition distributor is now only required for high-voltage distribution. This newly designed **high-voltage distributor** (Fig. 4) has undergone considerable constructional modifications which can be seen at a glance and which enable the distributor to be flanged to the cylinder head and the distributor rotor to be fitted directly to the end of the camshaft.
The load signal (air-intake quantity per piston stroke) comes from the air-flow sensor. In order to determine the engine speed, the computer counts the number of teeth on the flywheel ring gear by means of the inductive pickup.

Information regarding the crankshaft position is provided by a further pickup which generates an impulse each time the reference mark on the flywheel ring gear passes by.
A dwell-period control which, dependent upon engine speed and supply voltage, determines the dwell period (dwell angle), adapts the ignition energy to that required at the instant in question thus preventing unnecessary consumption of energy in the ignition coil. Furthermore, the final stage is provided with a current-limiting stage which means that the conventional ballast resistors can be dispensed with.
The computer program, of course, incorporates a peak-coil-current cutoff which prevents current flowing through the ignition coil below a given engine speed. This measure prevents the battery being discharged and the ignition coil heating up when the ignition is switched on.

## Ignition-curve "map"
(Fig. 3)

The conventional ignition distributor was only able to provide two linear spark advance curves. One of these was the centrifugal advance curve, which provided linear shift of the ignition point depending upon the engine speed. The other was the vacuum-advance curve resulting from the vacuum units which shifted the ignition point, depending upon manifold pressure, in either the advance or the retard direction.

This though, was an inadequate method because the engine needs a different ignition point for every load and engine speed.

The essential feature of the digital Motronic is the fact that the conventional linear shift of the ignition point (which was the only method possible up to now) has been superseded by a complex ignition-point map laid-out to suit the particular engine model concerned.

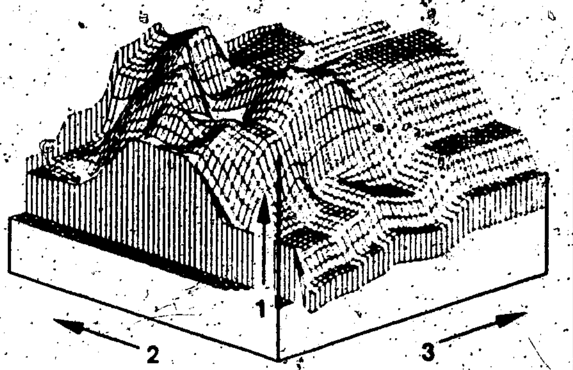


Fig. 3

**1** Ignition point **2** Load **3** Engine speed

The three-dimensional ignition-point map is plotted using the two co-ordinates load and engine speed (Fig. 3).

In accordance with the digital processing in the control unit, the ignition-point map is divided into small sections. Each crossing point of the resulting mesh occupies a memory location in the computer. This results in a large number of memory locations, in this case 256, each of which can be defined optimally.
Using a special interpolation process, the computer calculates values which lie between the memory locations. With each engine revolution, the computer "inquires" about the operating condition or mode of the engine and, using the programmed data, calculates the ignition point again. This means rapid adaptation to changes in the operating conditions.

A special advantage of the Motronic is the fact that during full-load operation the ignition point is always selected which results in maximum engine torque. This does not apply in ranges where the knock limit has to be taken into account. In this case, the distance to the maximum ignition point (knock limit) can be reduced due to the long-term constancy of the system. This distance is now determined solely by the engine, the conditions surrounding it and its age, but not by the system.

In the part-load range, the ignition point is adjusted for minimum fuel consumption whilst still complying with emission regulations.

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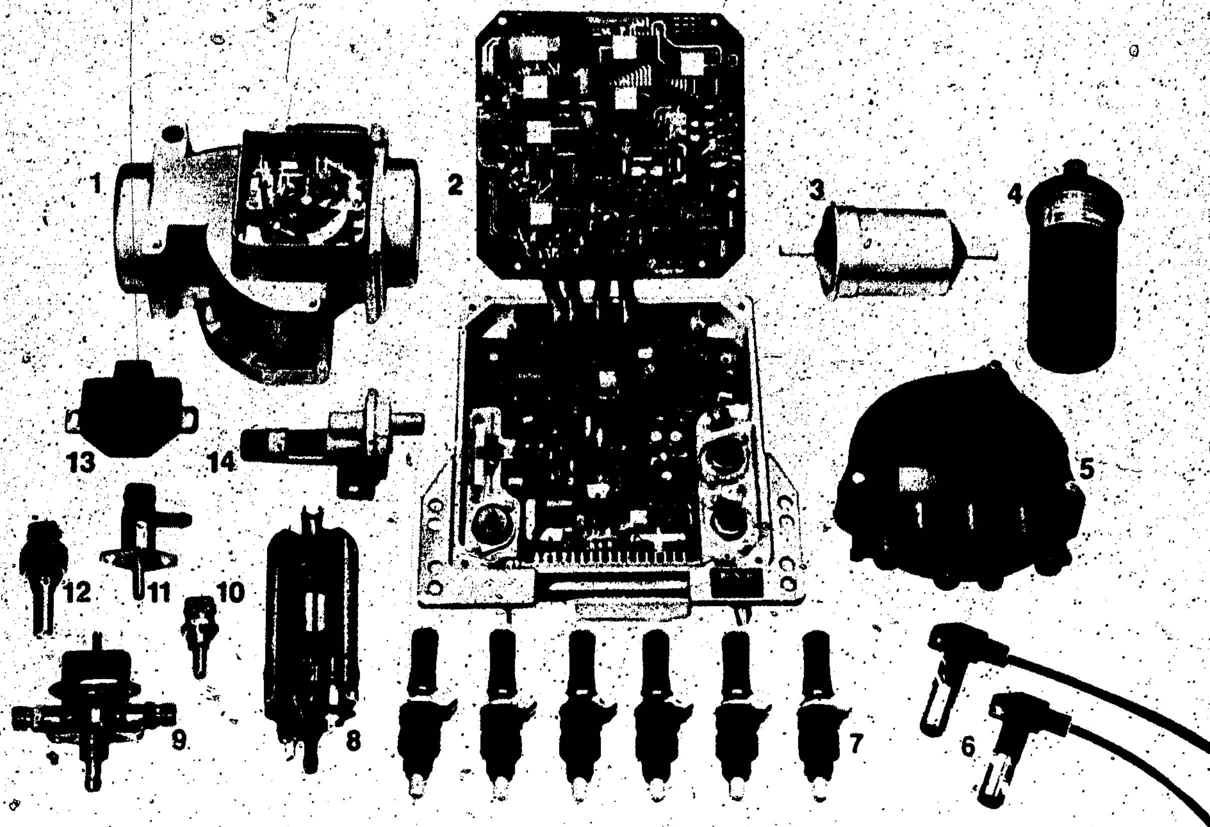


Fig. 4 Motronic components

1 Air-flow sensor
2 Control unit
3 Fuel filter
4 Ignition coil
5 High-voltage distributor
6 Reference-mark sensor and engine-speed sensor
7 Fuel-injection valves
8 Electric fuel-supply pump
9 Pressure regulator
10 Temperature sensor (engine)
11 Start valve
12 Thermo-start valve
13 Throttle-valve switch
14 Auxiliary-air device

F1

This information is available only in German. If necessary, please contact your regional representative.

Cette information n'est disponible qu'en allemand. Le cas échéant, veuillez vous adresser à votre représentation régionale.

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F2

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F3

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F4

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F6

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F7

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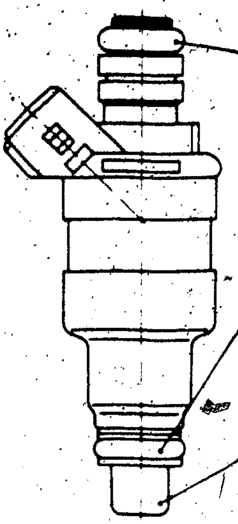
# PARTS SET FOR SOLENOID-OPERATED INJECTION VALVES 0 280 150 2.. AND PRESSURE REGULATORS 0 280 160 2..

Supersedes 8.1982 edition

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Contents for 1 injection valve:




Contents for pressure regulator:
1 O-ring
1 supporting plate

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight, is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and will in future be listed in the service parts microfiche under solenoid-operated injection valves (see EE 00 under 0 280..).

Please direct questions and comments concerning the contents to our authorized representative in your country.

MOTRONIC WITH COMPUTER-AIDED TRANSMISSION SHIFT AND KNOCK CONTROL

After-sales service procedure

VDT-I-261/103 En
8.1984
supersedes Ed. 12.1983

## Brief system description

The Motronic and the computer-aided transmission-shift system together form a functional unit. They make common use of some of the sensor signals.

Depending upon the operating mode of the vehicle at a given time, the computer-aided transmission shift determines which is the best gear to select in the automatic gearbox. When combustion knock starts, the knock control shifts the ignition point in the retard direction and, if necessary, also reduces the charge-air pressure from the turbocharger.

## Users

The BMW 745i is equipped with Motronic, computer-aided transmission shift and knock control as from 5.1983.

## Components

| | |
|---|---|
| Electronic control unit Motronic/ transmission shift | 0 261 200 .. |
| Electronic control unit, knock control | 0 261 201 .. |
| Knock sensor | 0 261 231 .. |
| Sensor, cylinder identification | 1 356 914 .. |
| Throttle-valve potentiometer | 0 261 211 .. |
| Automatic gearbox (non-Bosch) | |



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The part numbers are given in full on the appropriate vehicle-equipment Microcard AA...

Service parts/Exchange parts

The electronic control units will be available on the exchange system 12 months after having gone into series production (refer to microcards WB.. and PD 02).
The sensors are service parts.

Testing concept

The system is tested in the vehicle with the universal test adapter in connection with two special adapter leads for the Motronic and the transmission shift system. A multimeter is also needed. Special tools are not required.

Test equipment

| | |
|---|---|
| Universal test adapter ETT 018.01 | part no. 0 684 101 801 |
| Adapter lead for transmission-shift system | part no. 1 684 463 140 |
| Adapter lead for Motronic | part no. 1 684 463 124 |

Delivery through normal channels (BG, RG/AV).

Loan of test equipment

The adapter lead for the transmission shift system can be loaned from the RG/AV.

## Technical documentation

Motor-vehicle service information VDT-I-BMW 044 (knock and charge-air control), Technical Bulletin "New Product" VDT-I-261/3 (computer-aided transmission shift).
Trouble-shooting instructions and test specifications:
SIS-microcards BMW-00/E 121 (computer-aided transmission shift)
BMW-04/E 181 (knock control and charge-air pressure control)
BMW-04/E 21 (Motronic)

## System training

Special system training is necessary, and is incorporated in the Motronic course.

## Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

During the warranty period, components which are the subject of complaint are to be returned to our representative in your country for warranty assessment.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

# New Product



ECOTRONIC

New electronic mixture-formation system for spark-ignition engines

The ECOTRONIC mixture-formation system has been designed with the future stringent regulations in mind concerning fuel-consumption, emissions and operating characteristics.
It comprises a highly simplified carburetor together with actuator elements, an electronic control unit and sensors.

The ECOTRONIC covers the following electronic functions:

- Idle-speed control
- Control of air-fuel mixture enrichment during start, run-up, warm-up and acceleration
- Control of cylinder-fill during start, run-up and overrun
- Overrun fuel cutoff and engine stop

Compared to conventional carburetors, the ECOTRONIC has considerable advantages with regard to:

- Fuel consumption
- Emissions as limited by legislation
- Operating characteristics
  - Long-term stability due to simplified carburetor mechanics
  - Fully automatic starting system
  - Constant engine speed at idle
  - Full engine-braking effects
  - No bucking during overrun
- Servicing and diagnosis

The system has good "limp-home" characteristics.

Particularly in stop-and-go traffic, the ECOTRONIC system makes possible considerable reductions in fuel consumption. This is due to its precise control of the air-fuel ratio and the cylinder-fill under varying operating conditions. Optimization with regard to fuel consumption, emissions and driveability is made less complicated. The fact that the carburetor has been reduced to its basic system means that in addition an increase in reliability is achieved together with excellent "limp-home" characteristics. The electronically controlled actuators are an advantage also with respect to servicing and diagnosis because the carburetor, as a result, can be checked electrically or electronically. The possibility of system extension with further electronic functions for engine control is provided.

The ECOTRONIC system is used for the first time, on the 2B-E carburetor, in the BMW 316 and 518 models as from 9.1983.

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The ECOTRONIC system is comprised of the following main components:

1. <u>Carburetor (complete)</u>

   The carburetor comprises the following parts:

   - Throttle-valve section
   - Float chamber
   - Carburetor cover

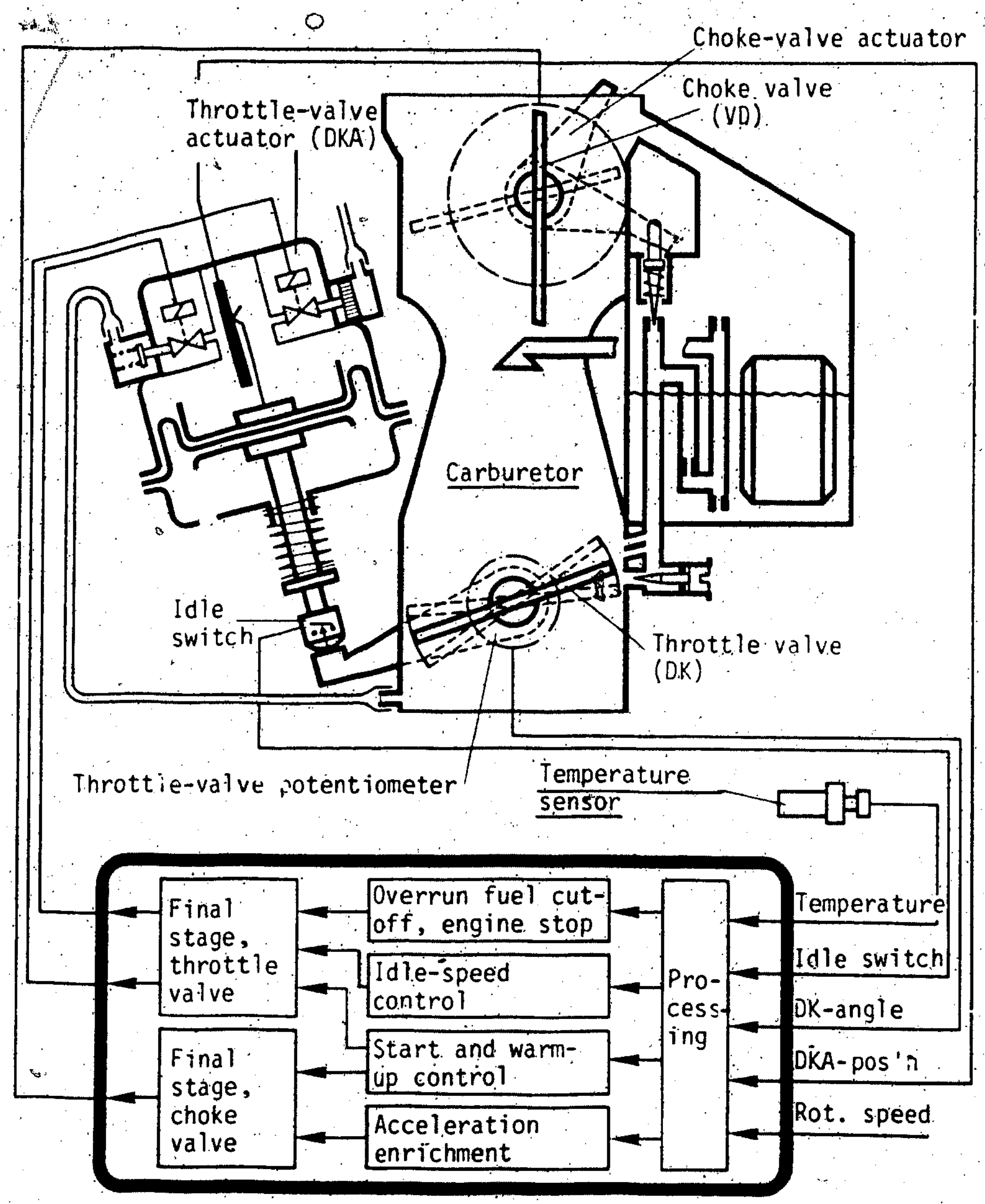
   Carburetor components:

   - Throttle-valve potentiometer
   - Choke-valve actuator
   - Throttle-valve actuator with idle switch

2. <u>Electronic control unit (ECU)</u>

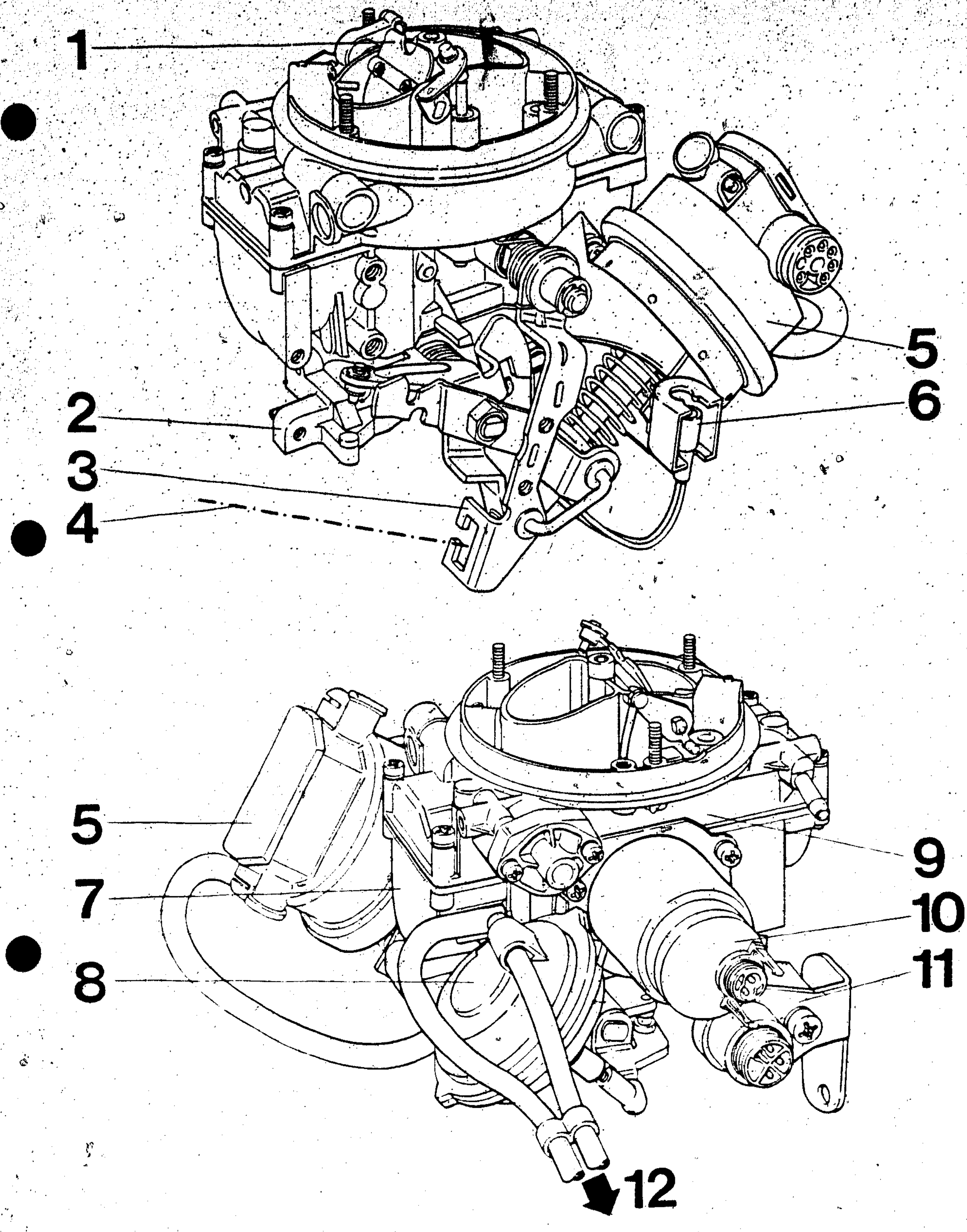
3. <u>Temperature sensor</u>

<u>ECOTRONIC-system (basic functions)</u>




Electronic control unit (ECU)

1-26012




1 = Choke valve
2 = Throttle-valve section
3 = Control lever
4 = Accelerator cable
5 = Throttle-valve actuator
6 = Cable connection f. idle switch
7 = Float chamber
8 = Aneroid capsule, stage II
9 = Carburetor cover
10 = Choke-valve actuator
11 = Throttle-valve potentiometer
12 = to thermo-valve

The ECOTRONIC system covers the following basic functions:

## Idle-speed control

The idle speed is maintained at a constant speed irrespective of the different influencing variables such as the engine drag, the intake-air temperature and the atmospheric pressure.

To do so, the engine speed is continuously measured and compared with a set value. In case of deviation, the throttle plate position is corrected accordingly by means of the throttle-valve actuator.

The closed-loop control system is designed such that the idle speed can be controlled in all temperature ranges which are likely to be encountered. The rotational-speed set value follows the engine temperature.

## Controlling the mixture enrichment during start, warm-up and acceleration

The engine needs a richer mixture when starting cold, and during warm-up and acceleration. Depending upon the engine speed, throttle-valve position, engine running time since cold start, engine temperature and opening velocity of the throttle plate, the electronic control unit calculates the appropriate enrichment quantity. The choke valve is then set accordingly and the enrichment quantity can be drawn in by the engine. During acceleration, the choke valve is briefly triggered in the "close" direction. Here, the closing moment, the closed period and the time function for opening the choke valve again are calculated depending upon the given operational parameters.

## Controlling the mixture quantity during start and run-up

The correct quantity of mixture needed to guarantee a certain start and smooth, unhesitating run-up, is provided by temperature and rotational-speed dependent control of the throttle valve. As soon as the set idle speed is exceeded for the first time, the control of cylinder-fill is taken over by the idle-speed control.

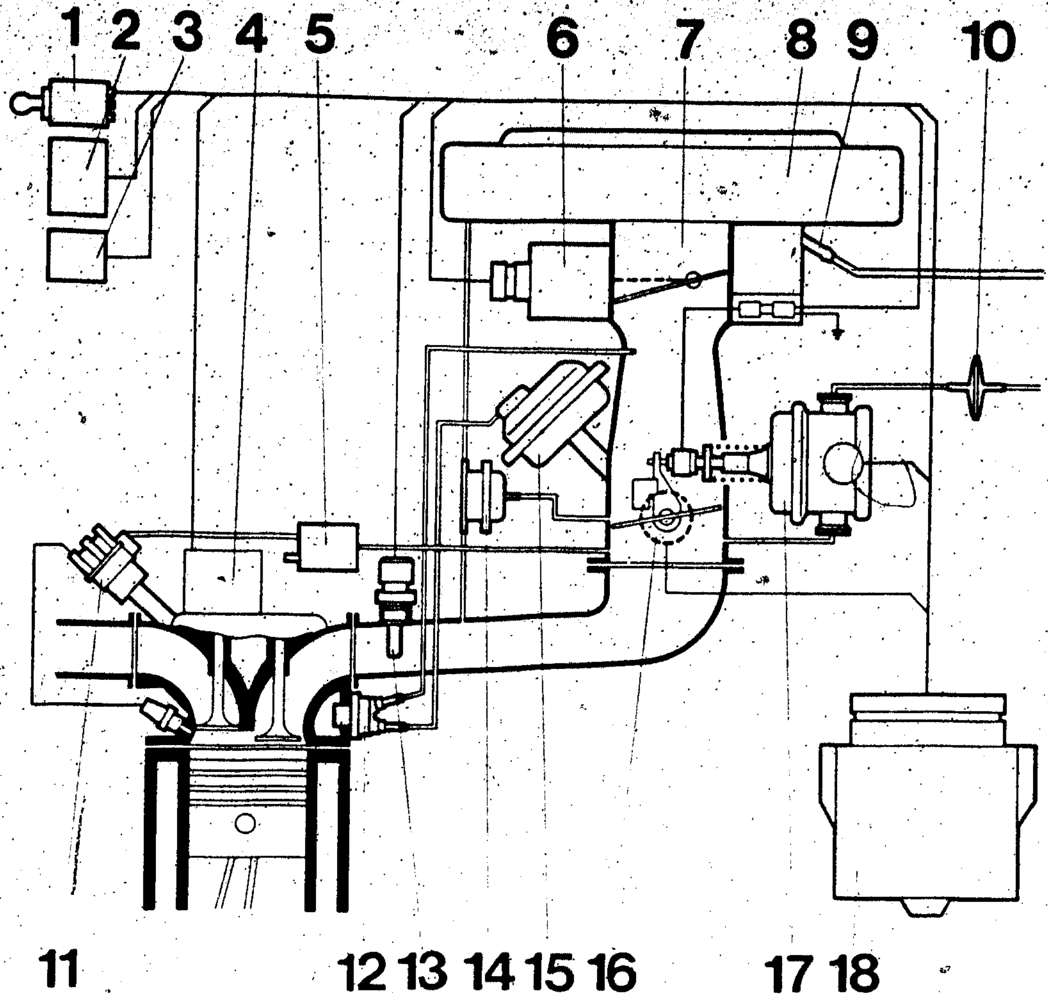
## Overrun fuel cut-off and engine stop

During the overrun phase the engine is not required to deliver power. In this operating mode, the overrun fuel cut-off switches off the supply of fuel to the engine. At the same time it supplies auxiliary air to the cylinders. Fuel cut-off and the increase of cylinder-fill at overrun take place by closing the throttle valve above an overrun threshold of 1400 min$^{-1}$. Cylinder-fill is increased by the overrun air valve controlling the increase of air input to the cylinders. The throttle valve and the choke valve are controlled such that when the overrun threshold speed is exceeded, controlled reinstatement of fuel delivery takes place with a resulting practically jerk-free resumption of combustion. If the foot is placed lightly on the accelerator pedal, this throttle-valve opening movement can be felt. When accelerating out of the overrun mode, fuel delivery and therefore combustion as well are resumed again immediately.

When switching off the engine, the supply of fuel is also interrupted by the closing of the throttle valve and "dieseling" is prevented. Once the engine has stopped, the throttle valve is shifted to the start position.

## Further functions

- Ignition-timing control:
  The idling-mode ignition point is dependent upon temperature and upon the position of the idle switch.
- Signal for calculating fuel consumption:
  The ECU outputs a signal for the fuel-consumption gauge. The signal is generated from the stored consumption data specific to the engine performance characteristics.




System overview of the ECOTRONIC-system (BMW 316/518)

1 = Ignition lock
2 = Main relay
3 = Fuel-consumption display
4 = Ignition trigger box
(engine-speed information)
5 = Solenoid valve
(ignition-point control at idle)
6 = Choke-valve actuator
7 = Carburetor
8 = Air filter
9 = Fuel supply connection
10 = Filter
11 = Ignition distributor
12 = Thermo-valve
(temperature-dependent damping)
13 = Temperature sensor
14 = Overrun air valve
15 = Aneroid capsule, stage II
16 = Throttle-valve potentiometer
17 = Throttle-valve actuator
18 = ECU

## Externally mounted components

### Throttle-valve potentiometer

This potentiometer serves to register the position and the movement of the throttle valve. The signal from the throttle-valve potentiometer is one of the various input quantities to the ECU which are used to electronically control the carburetor.

The potentiometer concerned is of the rotary type with integral return spring, and is positively connected to the throttle-valve shaft stage I by means of a coupling.

### Choke-valve actuator

The choke-valve actuator is used as the final controlling element for controlling the air-fuel ratio during start, warm-up and acceleration, as well as in the part-load ranges of the characteristic map (map correction). Enrichment is caused by the pressure drop generated at the choke valve when this closes, or by the needle control which depends upon the choke-valve position (reduction of the open-area of the idle-air correction jet).

Under given marginal conditions (air throughflow, choke-valve design), the change in the air-fuel ratio is essentially a function of the torque which is exerted at the eccentric choke valve. This means that the throttle-valve actuator acts a a torque motor whose output torque is a function of the current.

The anti-torque moment is generated by the force of the air applied to the eccentrically seated choke valve, and by the force of the needle spring for the (controlled) idle-air correction.

A linkage is used for transferring the actuator torque to the choke-valve shaft.

### Throttle-valve actuator with idle switch

The throttle-valve actuator is of the electro-pneumatic type and is used for the control of cylinder-fill. The actuator tappet can be shifted against the force of a return spring by a vacuum-operated diaphragm. The required working pressure is controlled by two solenoid-operated valves, one of which is connected to the atmosphere and the other to manifold pressure. A potentiometer is integrated in the actuator for reporting the position of the tappet.

The actuator tappet operates the carburetor throttle valve by means of a lever.

The cylinder-fill can be influenced electronically. It serves to control the idle speed under all operating conditions, and also to control the start, the run-up, the warm-up, the overrun fuel cut-off and the engine stop.

The idle switch is integrated in the actuator tappet. It recognises the contact of the throttle-valve lever with the tappet of the throttle-valve actuator.

The throttle-valve actuator also incorporates a filter (atmospheric-pressure side) and a non-return valve (Manifold-pressure side).

### Electronic control unit (ECU)

The ECU employs digital techniques. It can be sub-divided into input, processing and output stages. It also contains a microprocessor.

In the input stage of the control unit, the supply voltages for the sensors (throttle-valve angle, temperature, idle position) are generated and the signals from the sensors are digitalized. In the processing stage, incoming signals are processed according to fixed-programmed sequences and the output quantities calculated. These quantities are then transformed in the power stages of the output section and are used to control the actuator for operation of the choke-valve and the throttle valve. At the same time, another valve is switched (depending upon the operating mode) for switching the ignition and the main relay (control relay).

The operating conditions such as ambient temperature and electrical-system voltage vary considerably in the vehicle, and it is necessary to take measures in the ECU to guarantee its functional reliability under all conditions which can be met in practice.

Temperature sensor

The temperature sensor (NTC element) is used to register a "mixed" temperature coming from the intake-manifold wall and from the engine. This measured temperature is also used as an input value to the ECU.

E C O T R O N I C

(Electronically controlled carburetor)

After-sales service procedure

VDT-I-260/100 En

12. 1984

Supersedes Ed. 3.1984

## Brief system description

The Ecotronic consists of a carburetor reduced to its basic functions, together with actuators, an electronic control unit and the corresponding sensors.

Due to the precise control of the air-fuel mixture, the Ecotronic permits the optimization of fuel consumption, exhaust emissions and driveability.

The Ecotronic is a joint development by Bosch and Pierburg.

## User

Since 10.83, BMW has been equipping its 316 and 518 models with the Ecotronic. Since 4.84, Opel has been equipping its Rekord 1.8 l (Sweden, Switzerland) with the Ecotronic as well.

Technical Bulletin

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## Components

Control unit 0 260 200 ..

Temperature sensor 0 280 130 ..

Carburetor 34/34 2 B - E for BMW, and 28/30 2 E-E for Opel (only available from Pierburg Co.).

The exact part numbers are listed on the respective vehicle equipment microfiche AA... .

## Service parts / exchange parts

The control unit will be available as an exchange part one year after the start-up date (see WB.. and PD 02). The temperature sensor is a service part. Service parts for the carburetor are to be obtained from Pierburg.

## Test concept

The system is tested in the vehicle using the universal test adapter in conjunction with a special adapter lead as well as a commercially available multimeter and the oscilloscope.

The following special tool is required:

One feeler gauge (6.84 mm) for adjusting the throttle-valve part). Obtainable from:
Firma Korinth, Ludwig-Kloos-Straße 21, 6450 Hanau 7 (Steinheim), West Germany.

## Test equipment

Universal test adapter ETT 018.01, Part No. 0 684 101 801
Adapter lead Part No. 1 684 463 146
Supplied through the usual channels (RG/AV).

## Technical documentation

Technical Bulletin "New Product" VDT-I-260/2.
Trouble-shooting and test specifications:
SIS microfiche BMW-500 or OPE-510.

## System training

Integrated in the course on "Mixture preparation".

## Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period to our authorized representative in your country for warranty assessment.

Responsible:
Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Technical Bulletin

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

e.g. ignition systems, Jetronic, Motronic, ABS

VDT-I-227/107 En
1.1981

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency).
   Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

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We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

F25

F25

# NEW SYSTEM
# EGR SYSTEMS FOR PASSENGER-CAR DIESEL ENGINES

The following deals with electronically/pneumatically controlled exhaust-gas recirculation systems (EGR systems) for passenger-car diesel engines. Such systems are already used in US-model vehicles.

* EGR depending on a mechanical-pneumatic pressure transducer (BMW) 524 td).

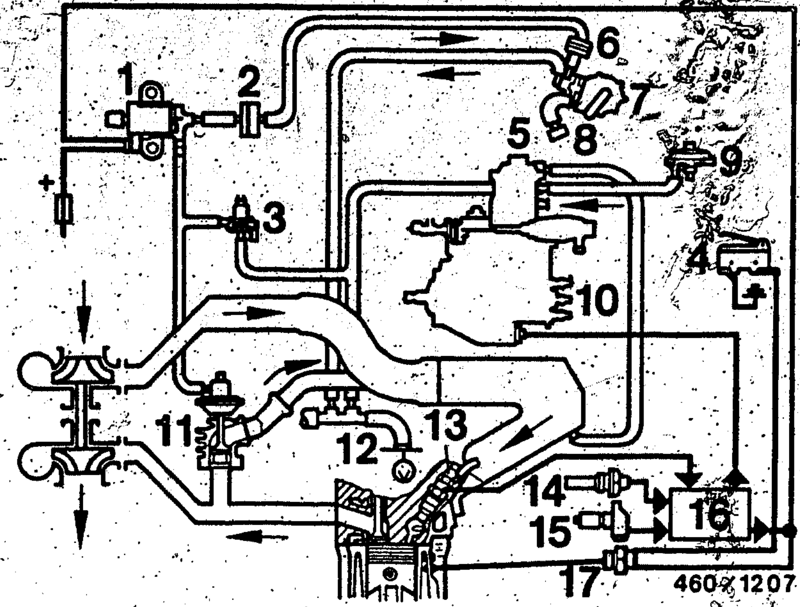
* EGR depending on air flow and duration-of-injection signal (Peugeot 505 Turbo-Diesel).

* EGR depending on a control-rod-travel (load) signal (Mercedes-Benz 300 SD Turbo-Diesel).

In order to improve the exhaust-gas emissions and to comply with the existing regulations as well as those to be expected in the future, more and more diesel-engined vehicles are being equipped with exhaust-gas recirculation (EGR).

The partial afterburning of the recirculated exhaust gases lowers the combustion temperature and reduces the emission of oxides of nitrogen ($NO_x$).

The EGR operates in the idle and part-load ranges of the engine. No exhaust gas is recirculated when the engine is cold.




Exhaust-gas recirculation (EGR) with pressure transducer

1 = Change-over valve
2 = Restriction
3 = ALDA air-admission valve
4 = Microswitch
5 = ALDA
6 = Damper
7 = Pressure transducer
8 = Filter
9 = Reference-pressure unit
10 = Timing valve
11 = EGR valve
12 = Vacuum pump (engine)
13 = Needle-movement sensor
14 = Temperature sensor
15 = Engine-speed sensor
16 = Control unit
17 = Temperature sensor

Operating principle of EGR with pressure transducer

A portion of the exhaust gas is recirculated to the charge-air pipe through a vacuum-controlled EGR valve (11).

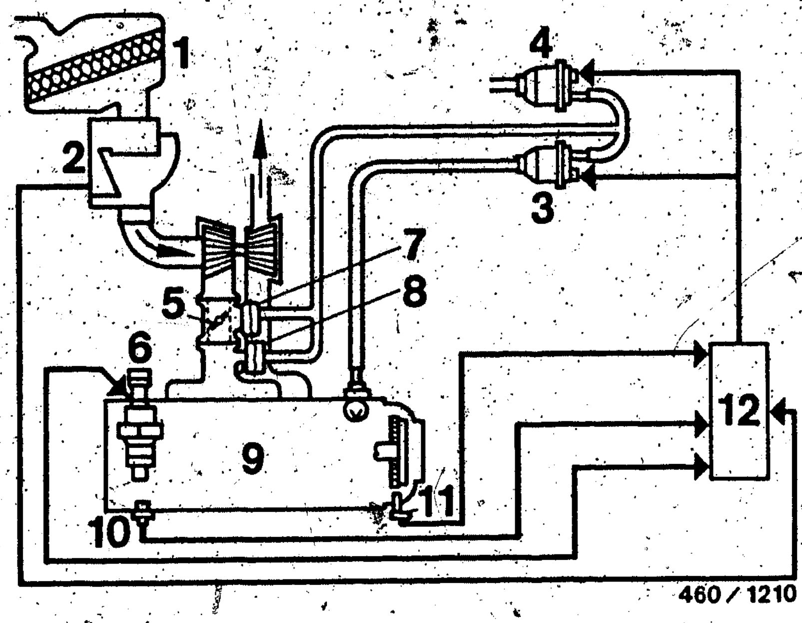
The EGR rate is adapted to the injected-fuel-quantity characteristic by means of the continuous changing of the control vacuum in a mechanical-pneumatic pressure transducer (7).

This pressure transducer is connected to the injection-pump control lever by means of a connecting rod and is fixed in a specified position with respect to the pump.

The operating tange of the EGR system is limited to the operating modes "idle" and "part load" by means of an electropneumatic change-over valve (1).

The change-over valve is energized at idle by a closed microswitch (4) and it is energized at part load within a specified engine-speed range by the control unit (16).

When the engine is cold, the EGR is switched off by temperature sensors 14 and 17.




Exhaust-gas recirculation with duration-of-injection signal

1 = Air filter
2 = Air-flow sensor
3 = Solenoid-operated valve (vacuum)
4 = Solenoid-operated valve (atmosphere)
5 = Throttle valve
6 = Injection nozzle with needle-movement sensor
7 = Throttle-valve vacuum unit
8 = EGR valve
9 = Vacuum pump (engine)
10 = Temperature sensor
11 = Engine-speed sensor
12 = Control unit

Operating principle of EGR with duration-of-injection signal

With this EGR system, the quantity of exhaust gas drawn in by the engine is controlled indirectly as a function of engine load and engine speed by measuring the fresh-air flow.

Signal measuring

A flap-type air-flow sensor (2) with potentiometer sensor measures the instantaneous value of the inducted fresh-air flow.

The load signal is picked off representatively for all other injection nozzles of the engine at a nozzle holder (6) in which a needle-movement sensor is integrated. The duration of injection is taken as a measure of the injected fuel quantity.

The engine speed is measured by an inductive sensor (11) with which the teeth of the flywheel ring gear are sensed.

A temperature sensor (10) measures the cooling-water temperature and switches the EGR off at temperatures below its switching threshold.

Signal processing

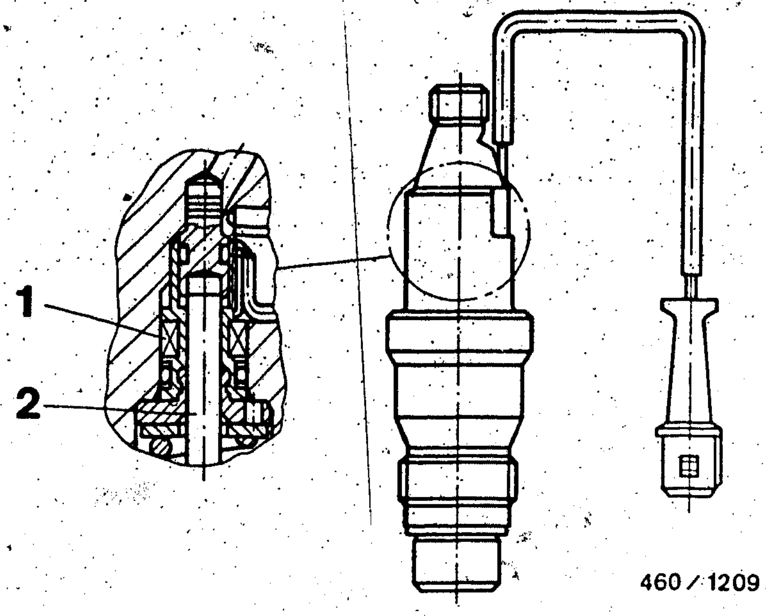
In addition to various characteristics for internal signal processing, two important characteristics/maps are stored in the control unit: the duration-of-injection/injected-fuel quantity map and the lambda characteristic with engine-speed correction.

The engine demand is thus precisely determined and the injected quantity is correctly metered by the injection system.

Duration of injection and engine speed are, therefore, the decisive parameters from which the control unit calculates a setpoint for the air-flow sensor voltage and compares it with the instantaneous fresh-air flow.

Possible deviations are detected by a 3-point controller (installed in the control unit). This controller alternately energizes two electropneumatic valves (atmosphere/vacuum) until the correct EGR flow (taken from the map) has been set by appropriate adjustment of the EGR valve and of the throttle-valve assembly.

In order not to negatively influence the load signal in the case of non-carbon-fouled nozzles (shorter duration of injection for same injected-fuel quantity than in case of carbon-fouled nozzles), the injection cycles are added up in a digital running-time module and, after the max. counter reading has been reached, they are gradually reduced by a correction amount in order to compensate.




1 = Needle-movement sensor
2 = Pressure spindle

Operating principle of injection nozzle with needle-movement sensor

DC is applied and regulated such that a constant current flows which is independent of temperature.

There is a gap in the magnetic circuit of the needle-movement sensor. The pressure spindle (2) changes this gap, which in turn leads to a change in the magnetic flux and a change in the signal voltage induced in the coil.

The amplitude of the signal voltage is proportional to the rate of change of the magnetic flux, which itself is determined by the velocity with which the pressure spindle moves and by the geometrical conditions in the gap.

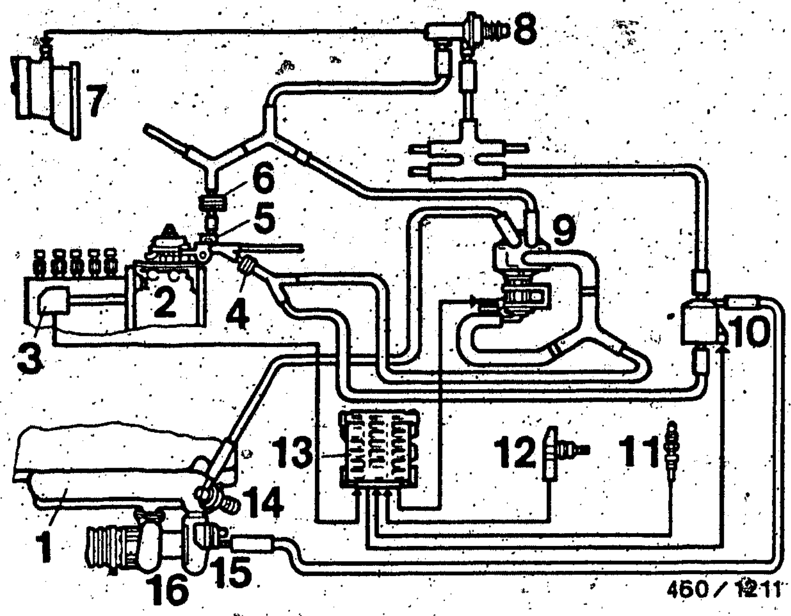
The signal characteristic is substantially influenced by the sensor gap.

The decisive factors are:

- Holder
- Adjusting pin
- Pressure spindle
- Intermediate disc
- Nozzle

A change in the nozzle components leads to a change in the sensor gap and, therefore, to a change in the signal voltage. This causes incorrect evaluation by the control unit.

For this reason, only the opening pressure may be changed during after-sales service. If the nozzle is defective, the complete nozzle-holder assembly must be replaced.




Exhaust-gas recirculation with control-rod-travel sensor

1 = Intake manifold
2 = Fuel-injection pump
3 = Control-rod-travel sensor
4 = Air-admission filter
5 = Vacuum-control valve
6 = Vacuum damper
7 = Vacuum pump (engine)
8 = Non-return valve
9 = Pressure transducer
10 = Change-over valve
11 = Temperature sensor
12 = Engine-speed sensor
13 = Control unit
14 = EGR valve
15 = Bypass-air safety valve
16 = Exhaust-gas turbocharger

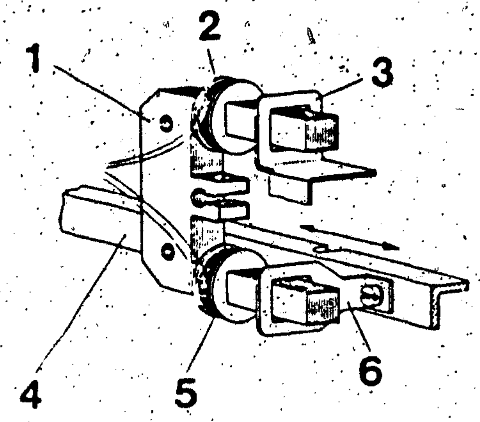
## Operating principle of EGR with control-rod-travel sensor

The vacuum generated by a vacuum pump (7) is transformed by the pressure transducer (9) into a load-dependent vacuum signal which is used to control the EGR valve (14).

Depending upon the load condition of the engine, a change-over valve (10) applies additional vacuum to a bypass-air safety valve (15) in the part-load range.

The charge-air pressure is thus partially reduced and the EGR rate is increased.

The control unit processes the input signals for control-rod travel, engine speed and engine temperature, and from the resulting signal controls the pressure transducer and the change-over valve.




460/1212

1 = Laminated iron core
2 = Reference coil
3 = Fixed short-circuit ring
4 = Control rod
5 = Measuring coil
6 = Movable short-circuit ring

Operating principle of control-rod-travel sensor

A reference inductance is formed by the reference coil (2) and the fixed short-circuit ring (3).
Depending on the position of the control rod (4), the distance between the movable short-circuit ring (6) and the measuring coil (5) is changed.
The resulting change in inductance is measured and from it the control unit calculates a control-rod-travel (load) signal.

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New Product 40...46, 58

START-OF-DELIVERY SENSOR SYSTEM VDT-I-413/1 En

for dynamic start-of-delivery testing 8/1984

on in-line injection pumps supersedes Ed. 4.1983

The timing of in-line injection pumps to the engine and the testing of the static start of delivery have so far been performed with the aid of the hydraulic overflow method by way of pointer and mark.
To simplify this usually elaborate series of operations, a measuring device has been developed for governor types RW.. and RSF.. . This device permits the following setting and testing methods:

- Locking the injection-pump camshaft with cylinder 1 in start-of-delivery position for mounting on the engine.
- Testing of the start of delivery with the engine running in order to guarantee precise, optimum timing of pump to engine.
- Possibility of measuring timing device operation as a function of engine speed.

This new method is used for the first time on Daimler-Benz passenger cars and is called start of delivery sensor system. At Daimler-Benz it is also referred to as RIV = governor pulse method.



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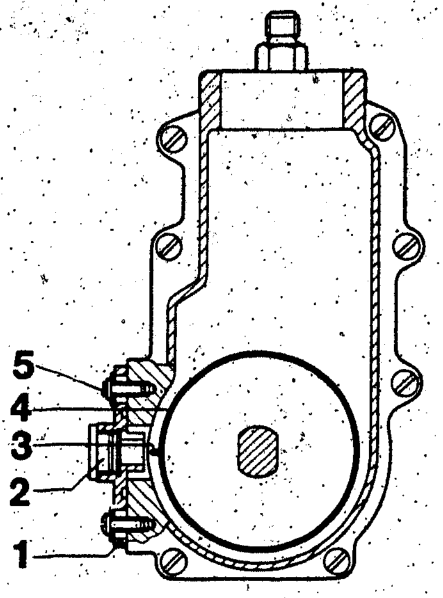


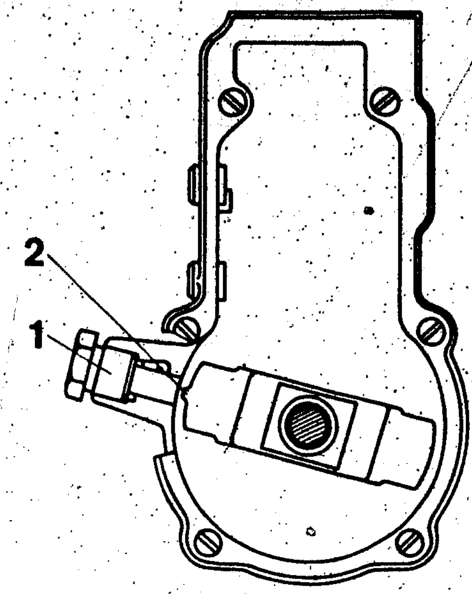

1 = Sliding flange
2 = Screw plug
3 = Lug (signal position)
4 = Flyweight capsule
5 = Tear-off screw M6

## Construction and principle of operation

To measure the timing of the injection pump to the engine, two signals are necessary:

- TDC pulse from engine crankshaft
- governor pulse from injection pump (lug on flyweight).

The MW injection pump with RW governor has been provided on the outside of the governor housing with a sliding flange (1) with mounting bore for a holding device and/or for an inductive pulse generator (screw plug (2) not a Bosch part). In addition, the flyweight capsule (4) of the governor has been provided with a lug (3) for signal triggering.




1 = Screw plug
2 = Lug (signal position)

The M.. injection pump with RSF II governor does not have a sliding flange on the governor housing. The mounting bore for the pulse generator/holding device has been incorporated in the housing.
There is a lug (2) directly on the flyweight for signal triggering.

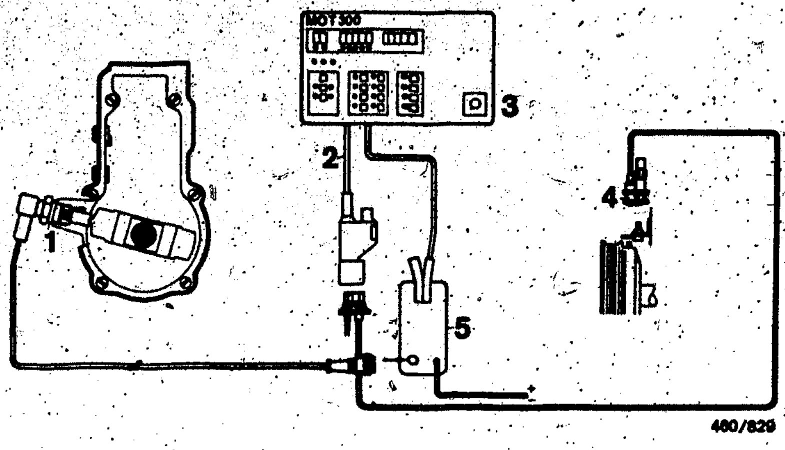
The signals are generated when the signal triggering devices (lug on flyweight part and TDC sensor pin on crankshaft flywheel) move past the inductive generators at a minimum speed (idle). A measuring instrument measures the time gap between the two pulses and converts the result into an angle which is then indicated.

Division K7 will soon be offering a suitable ballast unit for motortesters for this dynamic start-of-delivery setting procedure.
In addition, the diesel tester ETD 019.00, Part No. 0 684 101 900 which has been newly included in the sales program by K7 can also be used for this setting method.

## Injection timing and dynamic start-of-delivery testing

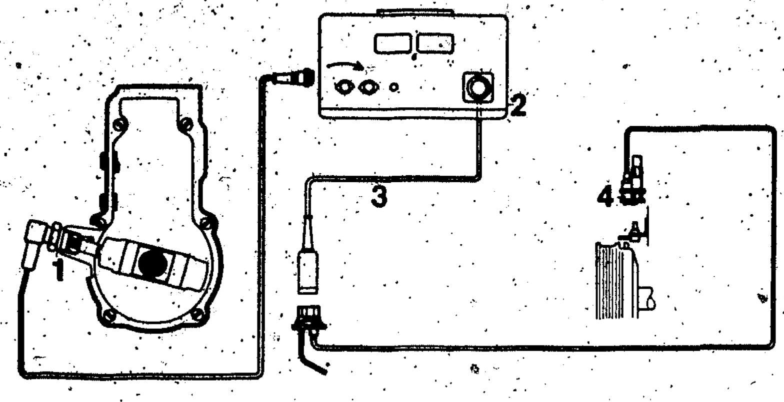
Turn engine crankshaft to correct position in accordance with setting instructions.
Insert injection pump in engine flange with holding device KDEP 1077.
Note:
Danger of damage to injection pump.
Immediately after installing the injection pump (fastening screws tightened) remove holding device KDEP 1077 and replace with screw plug.

Connect motortester with ballast unit or diesel tester in accordance with connection diagram and perform dynamic test.
See respective vehicle-related SIS microfiches for test specifications and setting values.




Connection diagram for dynamic start-of-delivery testing with ballast unit and motortester (e.g. MOT 300).

| | | |
|---|---|---|
| 1 = | Governor pulse generator Daimler-Benz | Part No. 617 579 102 100 |
| 2 = | Adapter lead Bosch | Part No. 1 684 463 094 |
| 3 = | Motortester MOT 300 Bosch | Part No. 0 684 000 300 |
| 4 = | TDC pickup Bosch | Part No. not yet specified |
| 5 = | Ballast unit Bosch | Part No. not yet specified |




Connection diagram for dynamic start-of-delivery testing with diesel engine tester ETD 019

1 = Governor pulse generator
    Daimler-Benz — Part No. 617 579 102 100
2 = Diesel engine tester ETD 019.00
    Bosch — Part-No. 0 684 101 900
3 = Adapter lead
    Bosch — Part No. 1 684 463 147
4 = TDC pickup
    Daimler-Benz — Part No. 601 589 042 100

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40...46, 58

DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE..L32/..L116 FOR VOLVO PASSENGER CARS MODEL 240 SERIES D 6 AND MODEL 760
Complaints Because of Black Smoke

VDT-I-460/140 En

7.1985

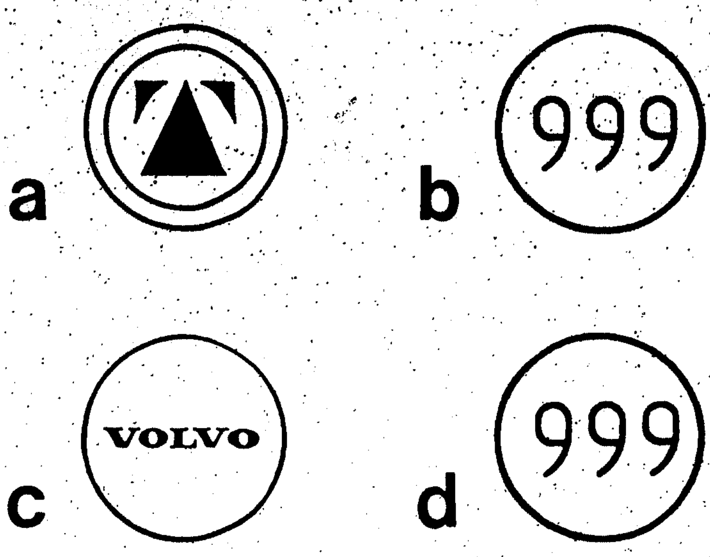
An increase in the fuel delivery of approx. 2 ... 3 $cm^3$/1000 strokes may lead with the above-mentioned distributor-type fuel-injection pumps for these vehicles to complaints because of black smoke.

To remedy this fault, it is not necessary to remove the pump. It is sufficient to turn the full-load adjusting screw 0.2 mm (approx. 1/4 turn) in a counterclockwise direction. The full-load adjusting screw should then be re-sealed with paint.

This work is to be performed free of charge for the customer within the warranty period.

Technical Bulletin

BOSCH Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.




**Note:**

If the full-load delivery has been reduced by the Volvo after-sales service, the full-load adjusting screw will have been provided with a black anti-tamper device (plastic cap) which is sealed with one of the above-shown lead seals:

| Sealed in | Front side | Rear side |
|---|---|---|
| Sweden | "T" seal (Picture a) | Officially registered no. of test agency (Picture b) |
| Other countries | VOLVO emblem (Picture c) | Officially registered no. of test agency (Picture d) |

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Technical After-Sales Service (KH/VDK 2)
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Technical Bulletin

# New product

**Gen.**

## 0 504 002 005 Level-Control Switch

VDT-I-Gen./21 En
10.1978

### 1. General

A hydro-pneumatic level-control system for the rear axle is now available on some vehicles as optional equipment.
BMW is the first passenger-car manufacturer to make this level-control switch available. It can be fitted in the 5.. and the 7.. models.

A level-control switch with electronic damping is used to control an electric pump and a solenoid valve. This level-control switch is delivered by Bosch under the above designation.

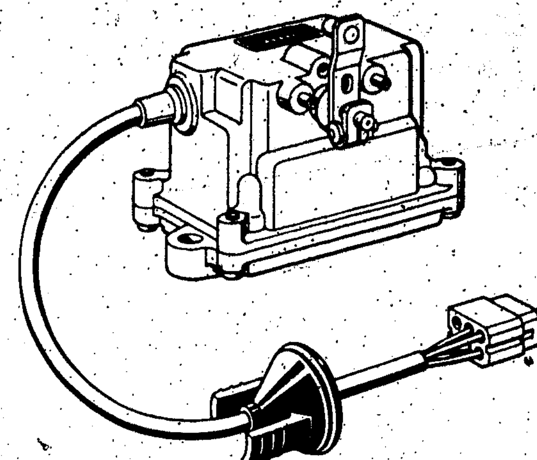

Fig. 1

Level-control switch

### 2. Block diagram of complete system

The level-control switch comprises an inductive level sensor (modulator), control electronics and acceleration switches.

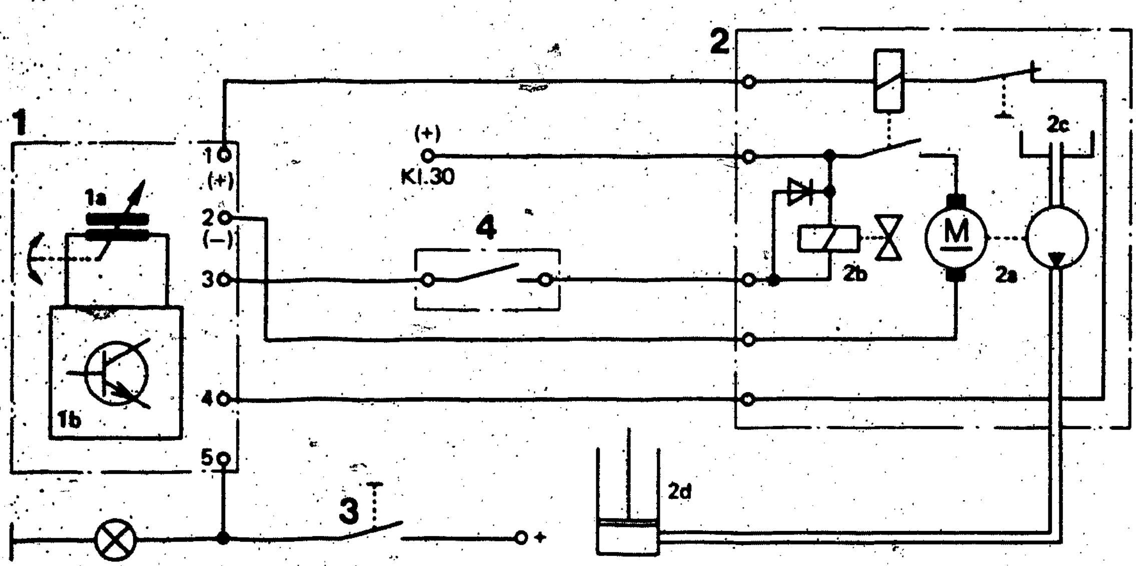


Fig. 2

1 = Level-control switch
1a = Inductive level sensor
1b = Control electronics on PC-board, and acceleration switches
2 = Hydraulic unit
2a = Electric-motor-driven pump
2b = "Lower" valve
2c = Oil tank
2d = Spring strut
3 = Stop-lamp switch
4 = Hydraulic switch



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## 3. Application

This product serves to control a hydraulic motor and a hydraulic valve which, in connection with spring struts, act as the level-control system of a passenger-car rear axle.

## 4. Construction

The mercury switches, the induction circuit, the short-circuit ring, and the PC-board with the electronic components and the PC-board relays, are fitted in an aluminum diecast housing. Taking into account its installation position in the vehicle, the level-control switch is appropriately sealed where the shaft and the cable pass through the housing, and between housing and cover.

## 5. Installation

The switch is installed underneath the vehicle chassis (near the differential and rear axle) by means of screws which pass through lugs cast on the side of the cover.

## 6. Operation

When the trunk (luggage compartment) is loaded, the vehicle is weighed down at the rear. As soon as the engine is started, the vehicle is returned hydraulically to its normal (level) position. When the trunk is unloaded, the springs first push the rear of the vehicle up in the air, this though is compensated for by the control mechanism lowering the vehicle to its normal (level) position again.

## 7. Function

By means of a lever linkage, up-and-down movements of the axle cause the short-circuit ring of an inductance to rotate. This change in position affects the inductance which, in turn, results in a frequency change of an oscillatory circuit in the evaluating electronics. If the frequency now exceeds, or drops below, a given reference frequency, the PC-board relays for either "lift" (hydraulic motor) or "lower" ("lower" valve) are activated through transistor circuits.

An electrical time-lag is incorporated in order to prevent too frequent control of the height of the vehicle, on a potholed track for instance, when the rear axle moves up and down rapidly. Acceleration switches (mercury switches) and the brake-light switches prevent the control-level switch from being activated and affecting the driveability of the vehicle during cornering, acceleration, and braking.

## 8. Checking the level-control switch when fitted in the vehicle

### 8.1 Preparations

Disconnect the control rod at the level-control switch, unplug the electrical connection in the trunk and connect as shown below in Fig. 3:

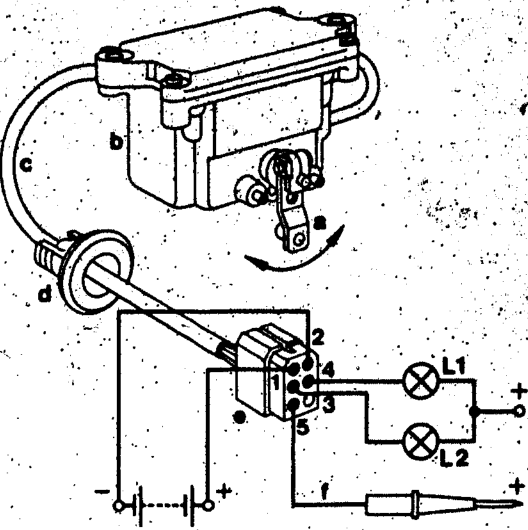


Fig. 3

a = Lever for control rod
b = Level-control switch
c = Connection cable
d = Grommet
e = Connection plug
f = Test line
L1 and L2 = 12V/10W test lamps

### 8.2 Checking

Move the lever to the left-hand stop and wait for the lamp $L_2$ to light up (time-lag max. 4 ... 8 s). Apply a brief positive pulse (B +) to Term. 5, the lamp must extinguish immediately. After the time-lag it must light up again.

Move the lever to the right-hand stop and wait for lamp $L_1$ to light up (time-lag max. 4 ... 8 s). Apply a brief positive pulse (B +) to Term. 5, the lamp must extinguish immediately. After the time-lag it must light up again.

When the lever is moved from one of the stops to the center position, the time taken for the lamp in question to extinguish is approx. 1 second.

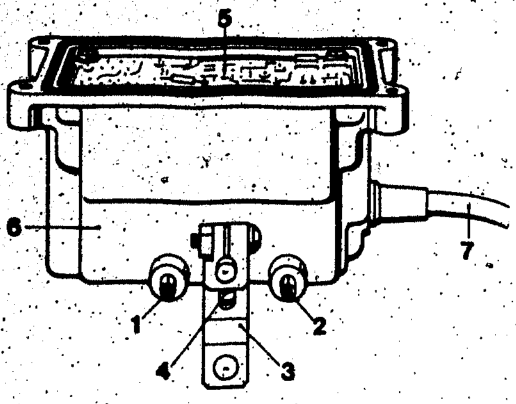


Fig. 4

1 = Left-hand stop
2 = Right-hand stop
3 = Lever
4 = Center position (the holes in the housing and lever must be aligned with one another)
5 = PC-board
6 = Housing
7 = Connection cable

If no defects have been discovered during this check, proceed to Section 9.

If a defect is discovered, replace the level-control switch.

## 9. Checking the level-control switch when removed from the vehicle

### 9.1 Preparations

Unplug the electrical connection to the level-control switch in the trunk, and push the grommet out through the bottom. Now remove the level-control switch.

### 9.2 Checking

For the first part of the check see Section 8.2.
In addition, the acceleration switches must also be checked. Move the lever to the left and then to the right, waiting in each case for the respective lamp to light. Leave the lever in either the right or left-hand position.
Now move the housing in all directions as shown by the arrows in Fig. 5.

**Note!**
After each movement in a particular direction the respective lamp will immediately extinguish, now wait for this lamp to light up again (time-lag). Repeat the test until all directions have been covered as shown in Fig. 5.

If a defect is not discovered during this check, then the hydraulic unit including spring struts must be checked. If there is a defect in the level-control switch, replace it.

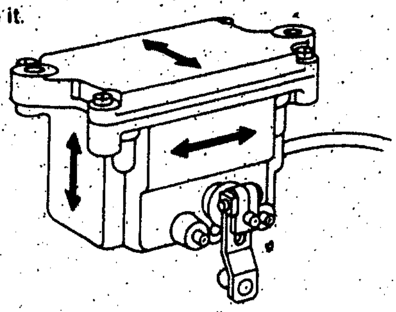

Fig. 5

# New Product

## Cruise control unit

Consisting of:
Final controlling element 0 261 001 001 and
Control box 0 261 001 100

Electronic cruise control unit with electromotive throttle valve adjustment.

The unit was included in 1977 for the first time as a standard feature in the AUDI 100 (5000) for export to the USA and as of 1978 as a special feature for Europe.

### 1. General function

With the unit it is possible to control vehicle speed from $V_{min.}$ (approx. 35 km/h) up to limit speed according to engine power more evenly than is possible using the accelerator. The unit may be switched off instantaneously and the idle position resumed at any time by operation of the brake or clutch pedal or the "Off" button.

### 2. The main components of the unit are:

1. The final controlling element with control motor and electromagnetic quick-acting coupling
2. The electronic control box

} Bosch products

3. The signal generator in the tachometer generator
4. The steering column-mounted control lever with 3 possible positions.
5. The switches on the clutch and brake pedals (latter already in existence)

} Included in scope of delivery of vehicle manufacturer

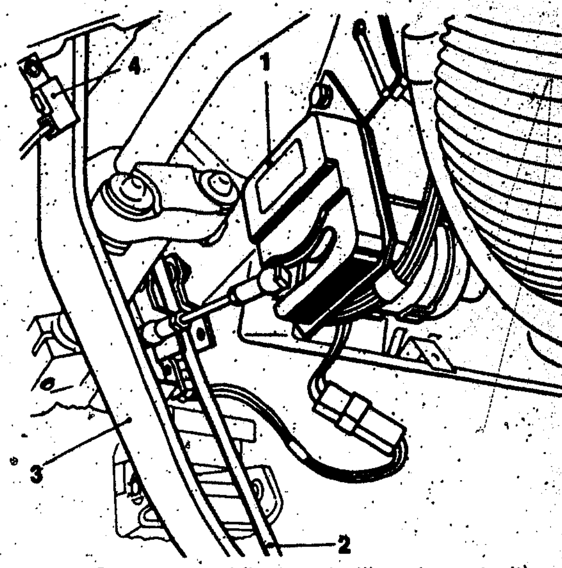


Fig. 1 Cruise control final controlling element with throttle linkage

1 = Final controlling element with control motor
2 = Accelerator pedal
3 = Brake pedal
4 = Coupling switch for control motor

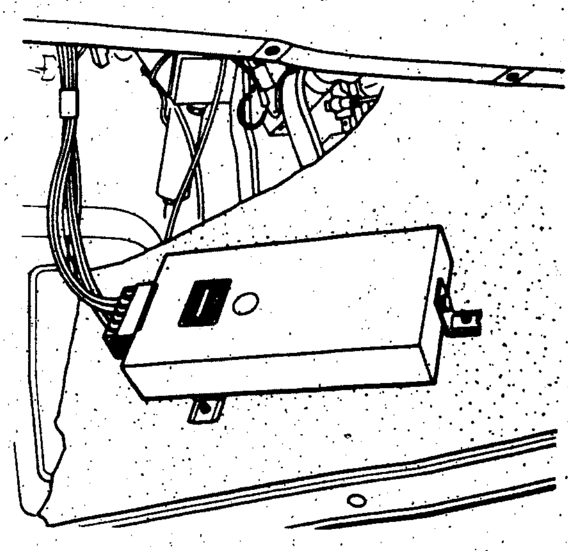

Fig. 2 Control box 0 261 001 100 for the cruise control unit fitted below instrument panel (above accelerator and brake pedals)

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**2.1**
A control motor (modified wiper motor) drives a coupling shaft in both directions of rotation via a worm and a worm gear which may be electromagnetically engaged. The polarity of the control motor is reversed to change the direction of rotation.
The rotation of the coupling shaft is transferred to a toothed swivelling lever by means of a pinion; this lever then produces a stroke movement. The throttle linkage, which is coupled to the lever, is moved in the same direction by this stroke movement. In the return direction, the toothed swivelling lever is under the spring force of the lever return spring and the throttle valve cable. When the magnetic coupling is relased, and the coupling shaft disconnected as a result, the throttle linkage is released and returns immediately to the idle position under the spring force. The control motor, together with the gear, electromagnetic coupling and feedback potentiometer, is designated as the "final controlling element". During operation, the control motor generally rotates for only tenths of a second. A complete revolution from idle position to full throttle position lasts approximately 2 seconds.
The feedback potentiometer, together with the switchgear, acts as an "electronic limit switch".

**2.2**
The control box contains in a flat aluminum housing a printed board with all electronic components of the cruise control equipment and a relay for coupling of the final control element (electromagnetic coupling). When the foot brake, clutch or "OFF" switch is operated, the relay disconnects the final controlling element coupling.
The control box is connected to the final controlling element by means of a multiple-conductor cable and multiple plugs.

**2.3**
The signal generator consists of a coil in a plastic housing. This is screwed directly on to the tachometer.

**2.4**
The steering column-mounted control lever (similar to the turn-signal control lever) has three positions. A light touch is sufficient to actuate the button.

**"ON / accelerate / set"**
When this button is pressed, the vehicle undergoes controlled acceleration. When the button is released, the speed at which the vehicle is travelling is "set" and subsequently maintained automatically without intervention by the driver as far as engine power and terrain permit.
The instantaneous speed can also be "set" **if the button is pressed briefly.**

**"Resume"**
The cruise control is switched off once the brake, clutch or "Off" button is operated.
Above time **minimum speed** $V_{min.}$ threshold (approx. 35 km/h), the unit can be switched on again by operating the resume button. The vehicle accelerates automatically up to the desired speed set and continues steadily at this speed.

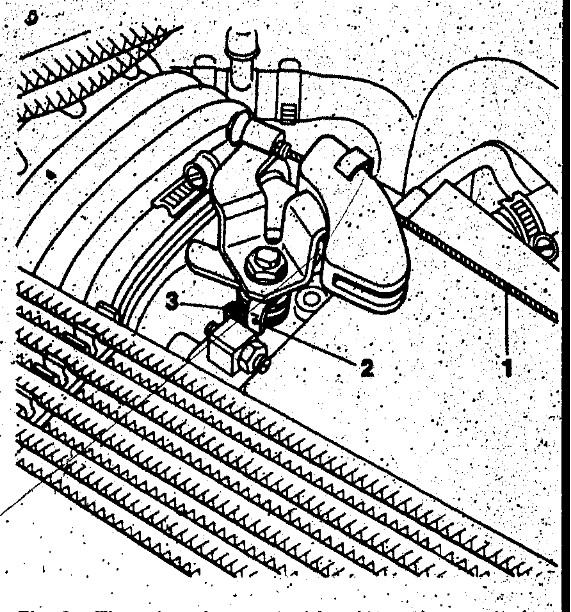



Fig. 3 Throttle valve control for the cruise control unit in the Audi 100 (5000)

1 = Accelerator cable
2 = Stop lever
3 = Spring pin

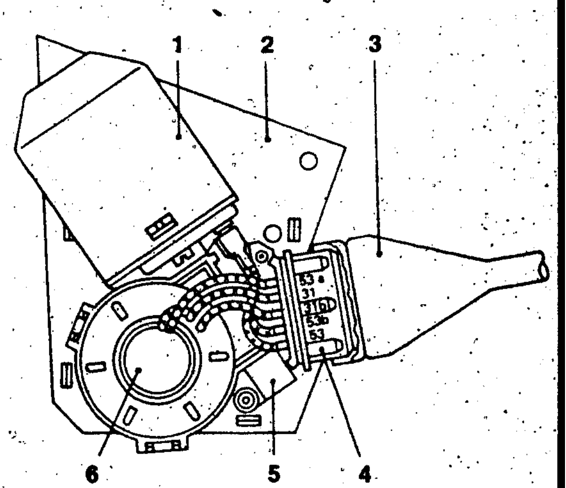



Fig. 4

1 = Control motor
2 = Base plate
3 = Cable to switchgear
4 = Five-pole connector
5 = Worm drive
6 = Potentiometer

G21



G21 C2 A2

**"Off"**
When the "Off" button is pressed, the cruise control is switched off, but the stored desired speed is maintained as long as the ignition lock is in the "on" position. The electromagnetic coupling disconnects the accelerator pedal from the control motor.

**2.5 Safety function**

2.5.1
The cruise control cannot be set below the "$V_{min}$ threshold" (approx. 35 km/h).
This provides protection against accidental switching-on when the vehicle is stationary (particularly in vehicles is stationary (particularly in vehicles with automatic transmission) and also acts as the first line of protection in the case of failure of the speed sensor signal.

2.5.2
Taking the set speed; if the vehicle is decelerated to 10 km/h (plus 0.25 times the set speed) below this figure, the cruise control is automatically switched off by this so-called "$\Delta$V threshold". This provides protection against a defective stop-lamp switch and is the second line of protection against failure of the speed sensor signal.

2.5.3
Two safeguards are included for switching off the final controlling element in any operation:

2.5.3.1
Breaking the mechanical connection between control motor and throttle linkage by disconnecting the electromagnetic coupling in the control motor. This may be done by operating
the "Off" button or
the brake pedal or
the clutch pedal.

2.5.3.2
In the case of a fault i. e. failure to open of the abovementioned electromagnetic coupling, the electric motor will return the throttle linkage to the idle position by one of the following means:
"Off" button or
operation of brake pedal or
operation of clutch pedal or
$V_{min}$ threshold or
$\Delta$V threshold.
The final stage is subsequently stopped electronically in the idle position in order to stop the control motor.

**3. Advantages of the cruise control unit with electromotive final controlling element**

No revving of the engine after disengaging the clutch in vehicles with manual transmission.
Full operating range, even with low-powered engines, since the unit is indepedent of the vacuum.
High degree of precision up to engine power limit.
No increase in braking distance.
Storage of desired speed value by digital memory for any length of time.

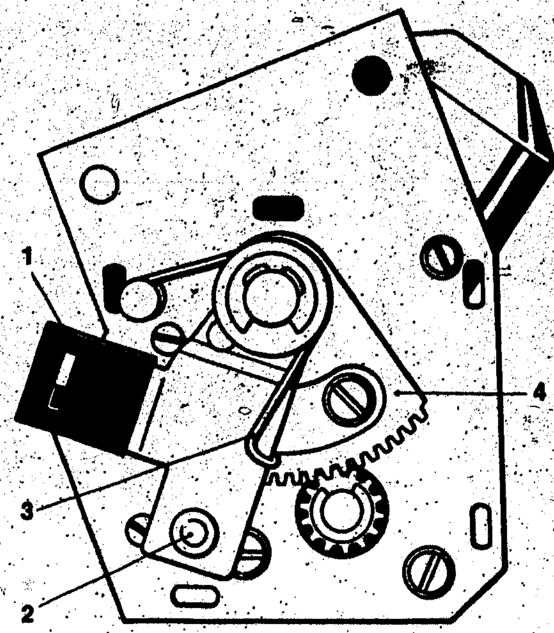



Fig. 5

1 = Idle stop (rubber buffer)
2 = Ball stud for connection to throttle linkage
3 = Return spring
4 = Gear segment rotates through approx. 44 ° from idle stop to full-load position

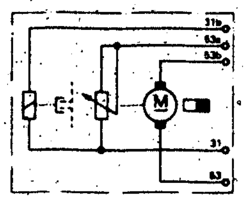



Fig. 6 Connection of final controlling element

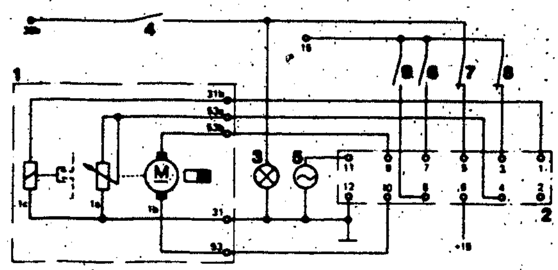



Fig. 7 Diagram of cruise control unit

1 = Final controlling element
1a = Control potentiometer
1b = Control motor
1c = Control coupling
2 = Control box
3 = Stop lamp
4 = Stop-lamp switch
5 = Tachometer generator

Switches for
6 = On / set / accelerate
7 = Coupling
8 = Off
9 = Resume

NEW PRODUCT

FAULT INDICATOR / CHECK CONTROL 0 263 100 .. 9.1981
for monitoring the lighting system, oil level, coolant and washing water from the driving seat.

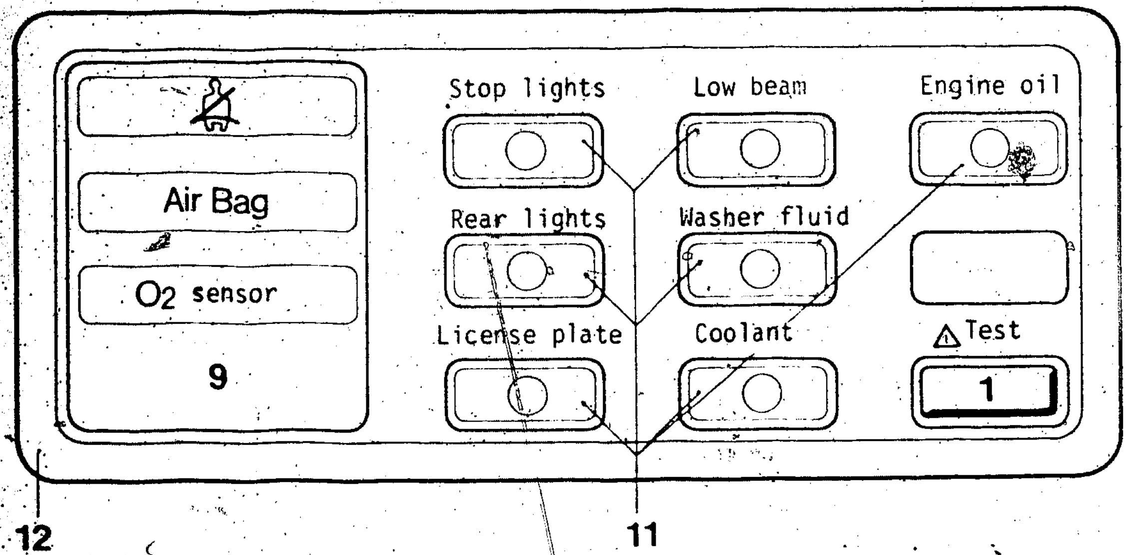
## General

In BMW vehicles 525i and 528i a fault indicator (BMW designation Check-Control) has been fitted above the inside mirror.
With this indicator the following functions can be checked before and during the journey:-

. stop lights : operation of bulbs, fuses and stop-light switch
. rear lights : operation of bulbs
. licence plate light : operation of bulbs
. lower-beam lights : operation of bulbs
. coolant : fluid level
. washing water : fluid level
. engine oil : dynamic fluid level (engine running), open circuit in the sensor cable

In addition three displays with the following control functions are intended for various foreign designs:-

. Fasten Seat Belts (USA design)
. Airbag (USA design from mid-1982)
. $O_2$ Sensor (exhaust) (USA design with gasoline engines)




1 = Test button
9 = Display windows for Festen Seat Belts, Airbag, $O_2$ sensor (export design)
11 = LED display for various functions
12 = Fault indicator/Check Control

## Method of operation:

When the ignition lock is in the "R" position (BMW = position 1) the Check Control does not light up, unless there is a fault in one of the monitored systems.

The following possible faults are indicated by the lighting up of all text displays and of the appropriate LED:-

. washing water (fluid level too low)

. coolant (fluid level too low)

. engine oil (stored dynamic oil-level faults, actual dynamic oil-level faults, open circuit in the sensor cable).

. stop light fuses (exactly as when both stop bulbs fail)

. stop lights, rear lights and license plate lights (failure of bulbs, display only when brake pedal is operated or when lights are switched on).

With the ignition lock in position "15" = "Ignition on" (BMW position 2) the central indicator light (F = 1Hz) blinks immediately, as do also all the text displays and the LED "Stop lights." These functions can be cancelled by operating the brake pedal, providing all systems are in working order.

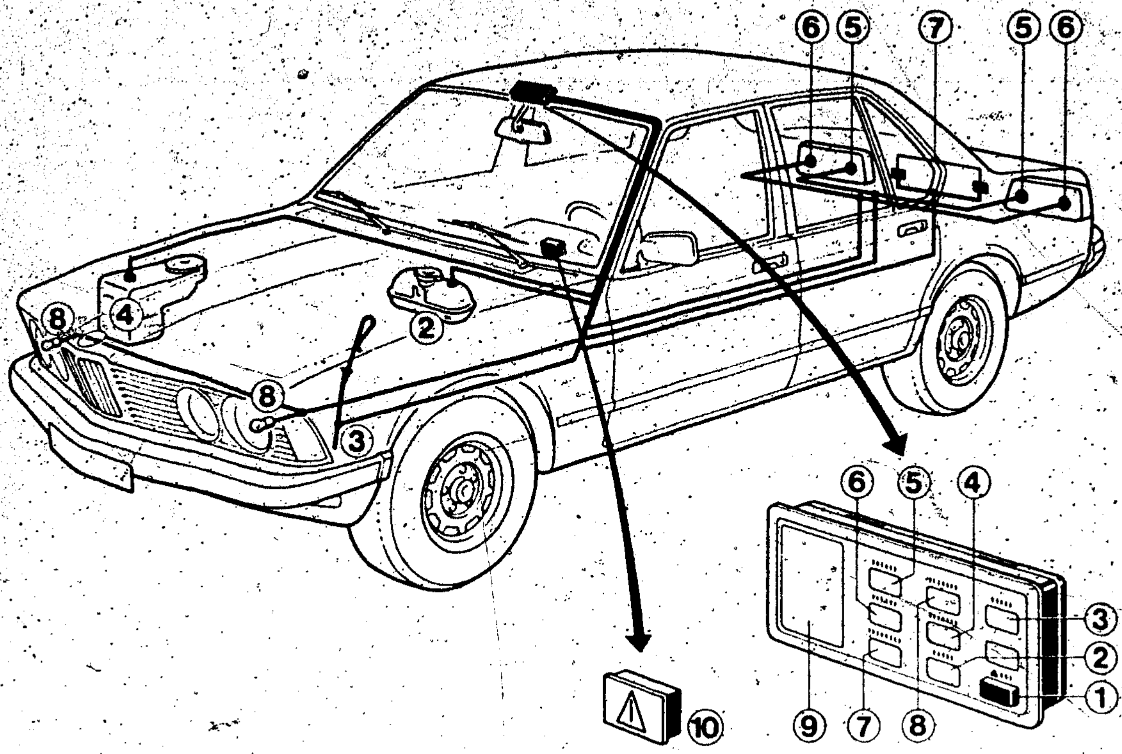
In addition to the checks which can be carried out with the ignition lock in position "R", the driving lights (lower beam) can also be monitored. If there is a fault this will be shown by the central indicator light blinking and by all text displays and the LED "Lower beam" lighting up.

When the button "Test" is pressed, all LED's and text displays light up. The central indicator light goes out. When the "Test" button is released, the LED's which do not indicate a fault, go out. All text displays remain alight for another 5 seconds before going out.
The LED which indicates a fault, only goes out when the ignition lock is switched off and the fault is remedied.
Once a fault is indicated it is stored and only cancelled by ignition lock position "0". However, these faults reappear from ignition lock position "15". An exception is the engine oil fault which is stored until the static oil level is corrected. Only then is it cancelled.

Special characteristics:

| | |
|---|---|
| Rear lights/license-plate lights: | Display delay approx. 0.5 seconds. |
| Lower-beam headlight: | Display delay approx. 0.5 seconds. |
| Stop lights: | Possible faults are indicated at ignition lock position "R" when the brake pedal is pressed or if a fuse blows. |
| Coolant/washing water: | If the fault is shown at ignition lock position "R" before or during the journey, the indication of the fault appears after a delay of approx. 0.5 seconds. If the fault occurs during the journey, the Check Control must register the sensor signal at least 10 seconds before the fault is shown by the appropriate LED and the simultaneous lighting-up of the central indicator light. |
| Engine oil: | Display delay approx. 10 seconds. If the dynamic oil level is too low at the start of the journey or if there is an open circuit in the sensor cable, the fault will be shown with a delay of approx. 0.5 seconds. |

## Position of the components in the vehicle




1 = test button
2 = coolant
3 = engine oil
4 = washing water
5 = stop lights
6 = rear lights
7 = license plate light

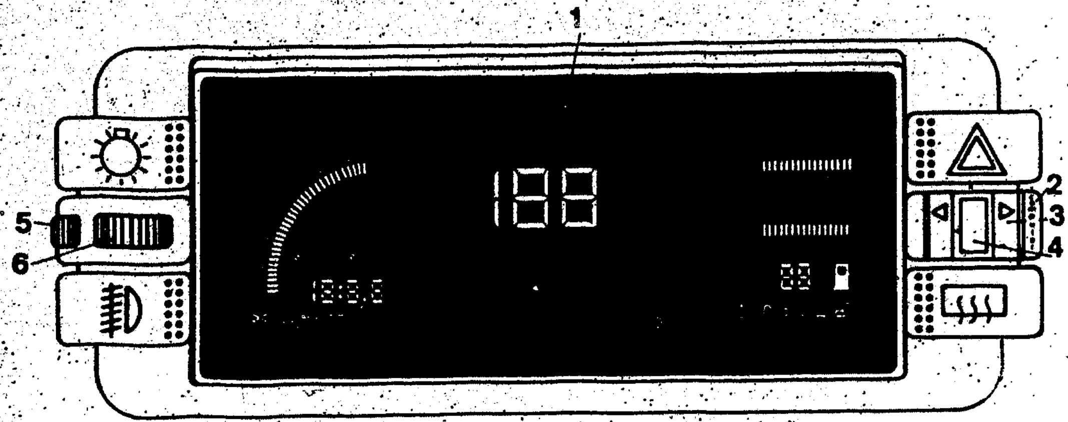
8 = lower-beam headlight
9 = with foreign designs
additionally: seat belt check
Airbag
$O_2$ sensor
10 = central indicator light

# New Product

VDT-I-263/2 En
10.1982

## COMBI-INSTRUMENT WITH ELECTRONIC DISPLAY IN VFD TECHNIQUE - 0 263 220 001/..002

Since September 1982 Bosch has been delivering a fully electronic combi instrument with integrated trip computer in VFD technique for the Audi Quattro (VFD = vacuum fluorescent display. The method of operation is similar to the teletube of an oscilloscope).




| | |
|---|---|
| 1 = Combi instrument in VFD technique | 4 = Reset button |
| 2 = Tester for trip-computer functions | 5 = Button for scope of display |
| 3 = Rocker switch | 6 = Regulator for display brightness |

Left-hand display: Speed sensor: 2 light segments enclose the speed to be shown, when the ceiling speed is reached the segments start to blink up to 6500 $min^{-1}$. Six trip computer functions are given.
Control and display lights, in conventional form (bulbs).

Center display: Speedometer: 0...225 km/h. Kilometer counter and trip odometer are mechanical and driven by step motor.

Right-hand display: Charge-air pressure display: 2 light segments enclose the charge-air pressure of the turbo charger to be shown.
Coolant temperature, fuel level: L, 5 ... 90 l, when less than 10 l of fuel are left, the petrol-pump symbol blinks.
Display lights in conventional form (bulbs).

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When the ignition is switched on all electronic displays are automatically controlled for a duration of 5 seconds. In the digital display of both the speedometer and the trip computer a 2 is shown in the first figure for 1 second and then a 1.

In the cover frame of the combi instrument there are 3 switches on the left and 3 on the right. The trip computer is operated with the middle switch on the right. By pressing the outer button (2) the following trip-computer functions can be called up:-

- Average fuel consumption in liters per 100 km
- Actual fuel consumption in liters per 100 km
- Average speed
- Range (until tank empty)
- Journey time
- Actual time
- Setting the clock (hours)*
- Setting the clock (minutes)

* For selecting this function operate the rocker switch (3) for at least 3 seconds.

With reset button (4), the trip-computer functions: average fuel consumption, average speed and journey time can be reset individually so that the counting process can start again at the beginning. However, this function is only possible with the ignition switched on.

With the ignition switched off the time can be called up with the reset button (4). At the same time other parts of the electronic display are turned up bright.

With button (5) the scope of the display can be reduced to such an extent that only the speed (speedometer) and distance travelled are shown.

The degree of brightness of the display can be adjusted with the regulator (knurled wheel)(6).

Warning function: If one of the limit values is exceeded or dropped below, full display is automatically switched on and the function concerned blinks. The limit values include: fuel in tank, water temperature, range and journey time (journey time blinks in order to warn the driver after 2 hours driving time that he needs a rest)

New Product

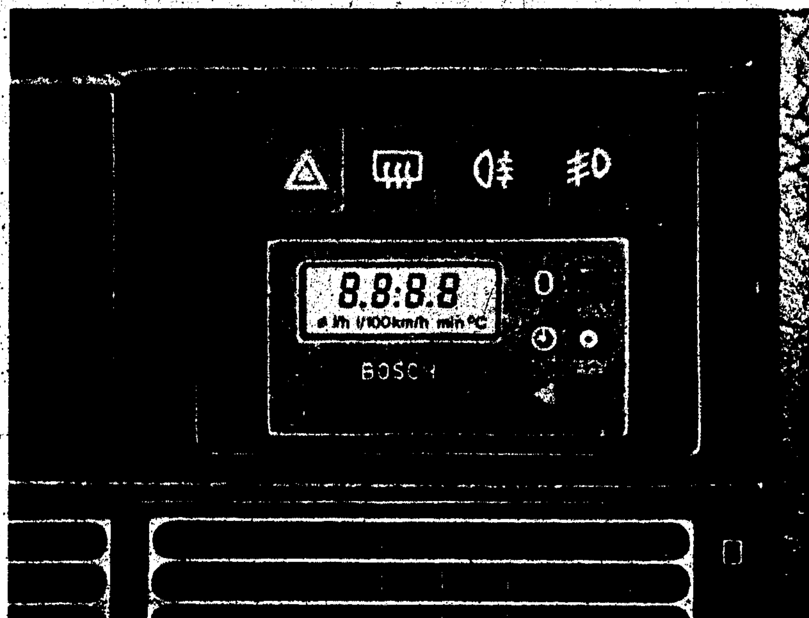
TRIP COMPUTER FOR

ALFA ROMEO Alfa 90

13...39

VDT-I-263/3 En

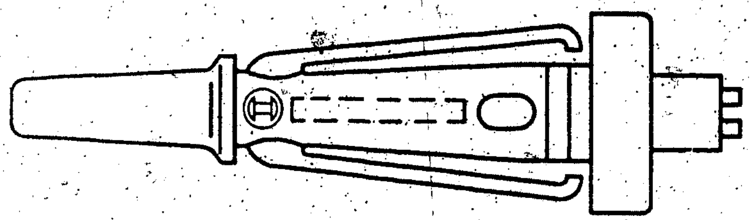
11.84




As of mid 1984 Alfa Romeo has been delivering the Alfa 90 (successor to Alfetta) with trip computer. The trip computer contains control and evaluation electronics.
It is installed in the instrument panel (see picture).

Technical Bulletin

BOSCH Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung.



Temperature sensor for outside temperature

The following signals are used as a basis of measurement:

1. Resistance of the NTC resistor in the temperature sensor (Bosch), installed in the front wheel housing.

2. Injection signal $t_i$ of L, LE-Jetronic and Motronic

3. Speed signal from the speedometer (Alfa).

4. Fuel-level-sensor voltage (Alfa)

With the ignition off, the trip computer shows the time.

When in this state, the operating keys on the trip computer have no effect and the display lighting is off.

With the ignition on, the following functions can be called up one after the other by means of the keyboard on the trip computer.

- Instantaneous fuel consumption

  Reading in l/h below 20 km/h
  Reading in l/100 km above 20 km/h

- Average fuel consumption

  Reading in av. l/100 km

- Average speed

  Reading in av. km/h

- Range (km to empty)

  Reading in km

- **Stopwatch**

  Reading

| Time | Figures indicate | | | |
|---|---|---|---|---|
| up to 10 min | min | sec | sec | 1/10 sec |
| up to 60 min | min | min | sec | sec |
| up to 100 h | hr | hr | min | min |
| as of 100 h | hr | hr | hr | hr |

- **Outside temperature**

  Reading in °C.

If the priority key (clock symbol) is actuated, the time is always displayed.

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FAULT INDICATION/CHECK CONTROL

VDT-I-263/100 En

0 263 100 ..
After-sales service procedure

8.1984
supersedes Ed. 4.1983

## System description

The failure of, for example, a stop lamp, tail lamp, low oil level or low windshield washer fluid level is indicated on the fault indication panel before or during driving. (The operating principle is described in detail in Technical Bulletin VDT-I-263/1).

## User

BMW is the first vehicle manufacturer to equip the vehicles 525i and 528i as of 9.81 with check control.

## Components

Check control unit 0 263 100 .. (for Part No. see respective vehicle equipment microfiche AA..).
The other components, such as bulb-monitoring units, oil-level sensor, coolant sensor etc., are neither made nor supplied by Bosch.

## Service parts/exchange parts

It is not possible to repair the check control unit.
The check control unit is available as an exchange part.





H5

### Test concept

The system is tested in the vehicle using a test adapter and a commercially available multimeter.

### Tester *

Test adapter KDVM 7601.

* Available from BG tester hire service (for Federal Republic of Germany only).
  (Can be hired if required for testing from BG.)

### Technical documents

Technical Bulletin "New Product" VDT-I-263/1.
Trouble-Shooting Instructions and Test Specifications:
SIS Microfiche BMW-00/E81.

### System training

Special training is not necessary.

### Retrofitting

This system is not intended for retrofitting.

### Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period for warranty assessment to the responsible national agent.

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TRIP COMPUTER — VDT-I-263/101 En

After-sales service procedure — 8.1984

Replaces Ed. 8.1983

## System description

With the trip computer it is possible to call up various functions and to read them off on a display unit. These include information on fuel consumption, average vehicle speed, outside temperature, time, etc. (The operating principle is described in Service Bulletin VDT-I-OPE 020 En).

## User

Opel is the first vehicle manufacturer to offer the trip computer for the vehicle models Senator and Monza (models as of 2.82).

## Components

| | |
|---|---|
| Trip computer | 0 263 001 .. |
| Operator keyboard | 2 267 001 .. |
| Temperature sensor | 0 335 500 .. |

The precise part numbers are listed on the respective vehicle equipment microfiche AA.. .
The speedometer signal generator and tank sensor are neither made nor supplied by Bosch.



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## Service parts/exchange parts

It is not possible to repair the components of the trip computer.
The computer is available as an exchange part (see microfiche WB.. and exchange-price list PD 02) and both the operator keyboard and the temperature sensor are available as service parts.

## Test concept

The system is tested in the vehicle using the universal test adapter in conjunction with a special system adapter cable as well as a commercially available multimeter.
Special tools are not required.

## Testers

Universal test adapter ETT 018.01, part no. 0 684 101 801 (supplied in the usual manner).

Adapter cables KDES 0002/0003 can be requested for testing from the relevant RG/AV in your country.

## Technical documentation

Service Bulletin "New Product" VDT-I-OPE 020 En, trouble-shooting instructions and test specifications are on SIS microfiche OPE-00/E81.

## System training

Special training is not necessary.

## Retrofitting

This system is not intended for retrofitting.

## Warranty procedure

Components which are the subject of complaint should be sent in during the warranty period for warranty assessment to the responsible national agent.

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COMBI INSTRUMENT WITH ELECTRONIC DISPLAY VDT-I-263/102 En

0 263 220 ... 8.1984

After-sales service procedure Replaces Ed. 8.1983

## Description of the system

The fully electronic combi instrument with integrated trip computer shows various functions digitally (speed, fuel capacity, etc.) and quasi analog (engine speed, coolant temperature, etc.). These functions are shown on a display field.

## First applicant

Audi is the first vehicle manufacturer to use the combi instrument and it has been fitted into the Quattro as from date of manufacture 9.1982.

## Components

Complete combi instrument 0 263 220 ..
The exact part numbers are listed on the appropriate vehicle equipment microfiche AA... .

## Service/exchange parts

The combi instrument complete is offered as an exchange part*, the front frame with glass and voltage transformer are service parts**.
* see exchange microfiche WB ..
** see service parts microfiche EE-00 under 0 263 220 ..



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H11

## Testing

The system is tested in the vehicle with the aid of the universal test adapter together with a special system adapter cable and a commercially available multimeter. No special tools are required.

## Test equipment

Universal test adapter
ETT 018.01, part no. 0 684 101 801.

Available in the usual way.
Adapter cable KDES 0001 can be requested for testing from the relevant RG/AV in your country.

## Technical documentation

Technical Bulletin "New Product" VDT-I-263/2 En.
Trouble-shooting instructions and test specifications: SIS microfiche AUD-03/E81.

## Training

Special training for this system is not necessary.

## Retrofitting

This system is not intended to be retrofitted.

## Guarantee procedure

Components on which a claim is made should be sent during the guarantee period to our regional representative for examination.

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VFD INSTRUMENT CLUSTER VDT-I-263/103 En

Modification to adapter lead 6.1985

Adapter lead KDES 0001 has been used for testing the VFD instrument clusters

0 263 220 001 ... 008 (Audi-Quattro).

2 additional test steps have become necessary for VFD instrument clusters

0 263 220 009 ... 012
(Quattro, 90 Coupé, Coupé Quattro,
90 Quattro for EU and United Kingdom
as of 9.1984).

For this reason, adapter lead KDES 0001 has been converted and at the same time renamed KDES 0011.

Adapter lead KDES 0011 and universal test adapter 0 684 101 801 can now be used for testing VFD instrument clusters 0 263 220 001 ... 012.

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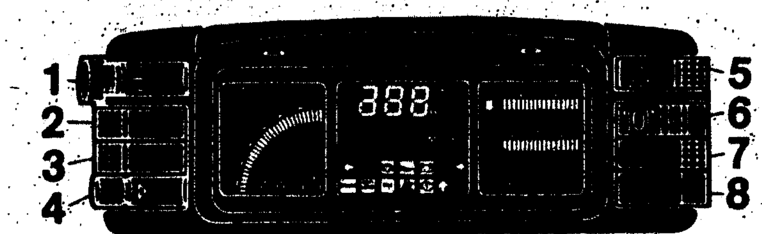
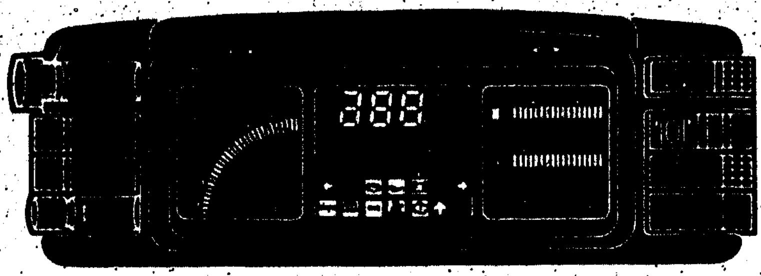
Technical Bulletin

NEW SYSTEM
INSTRUMENT CLUSTER WITH ELECTRONIC
LCD DISPLAY
0 263 220 013, .. 014

00 ... 12
VDT-I-KFZ / 2 En
12.1985
supersedes Ed. 8.1985
1-263/4




1 = Rotary light switch
2 = Blank
3 = Blank
4 = Brightness control for instrument illumination and
    reduced-display switch (MIN/MAX)
5 = Hazard-warning switch
6 = On-board computer rockers and reset button
7 = Heated-rear window switch
8 = Blank



As of the beginning of 1986 Bosch is supplying Audi with a fully electronic LCD (Liquid Crystal Display) instrument cluster with integrated on-board computer for the AUDI 4000 Coupé (USA and Canada).

1. Available information

Engine speed
Average fuel consumption
Average speed
Range (miles to tank empty)
Travelling time

Instantaneous speed (speedo)
Odometer miles, total, switchable to trip meter
Various indicator lamps

Tank level
Coolant temperature
Time of day

## 2. Scope of display

The amount of information can, if desired by the driver, be reduted in two stages:

Reduced-display 1:
Instantaneous speed
Odometer/trip odometer
Time of day

Reduced-display 2:
As 1, but without time of day

Switchover is by means of the MIN/MAX button 4; (see 8.8)

If critical values for

| | |
|---|---|
| Tank level | (< approx. 7 l) |
| Range of tank | (< 50 km; < 30 miles) |
| Coolant temperature | (> approx. 120°C) |

are exceeded, there is an automatic switch-back to the full display.

## 3. Systems of dimensions

Different systems of dimensions are used in the USA and Canada. The instrument cluster caters for both. Selection is by means of the on-board computer rockers 6 (see 8.4).

## 4. Odometer display

Odometer and trip meter have a common display. Switchover is by means of the on-board computer rockers 6 (see 8.5).

## 5.2 On-board computer

| Function | | Display USA | Display Canada |
|---|---|---|---|
| Average fuel consumption | (*) | MPG AVE | 1/100 km |
| Average speed | (*) | AVE MPH | km/h |
| Range, miles to empty | | FUEL RANGE | — |
| Travelling time | (*) | ELPSD TIME | |

(*) Calculated as of time of operation of on-board computer reset button (approx. 2 sec) whereby one of these 3 functions must have been selected.

The selected function is indicated in the text field according to the selected system of dimensions (USA/ Canada).

The functions are selected by briefly pressing the right-hand or left-hand on-board computer rockers.


## 6. Center display panel

### 6.1 Instantaneous speed / speedometer

Digital display, according to the selected system of dimensions in MPH or km/h.

| | | | |
|---|---|---|---|
| USA | : | 0; | 3...159 MPH |
| Canada | : | 0; | 5...255 km/h |

### 6.2 Odometer / trip meter

Digital display of one of the two functions, according to the selected system of dimensions in MLS or km. Selectable by means of on-board computer rockers (see 8.5).
Trip meter is reset (to zero) by pressing the on-board trip computer reset button in "odometer/trip meter" selection mode with "trip meter" function selected (see 8.6).


<u>6.3 Indicator lamps</u>

Turn-signal indicator / blinker left/right

Heated rear window

Handbrake; brake-fluid level

Engine-oil pressure

Battery charge indicator lamp

Upper beam

ABS fault (optional extra)

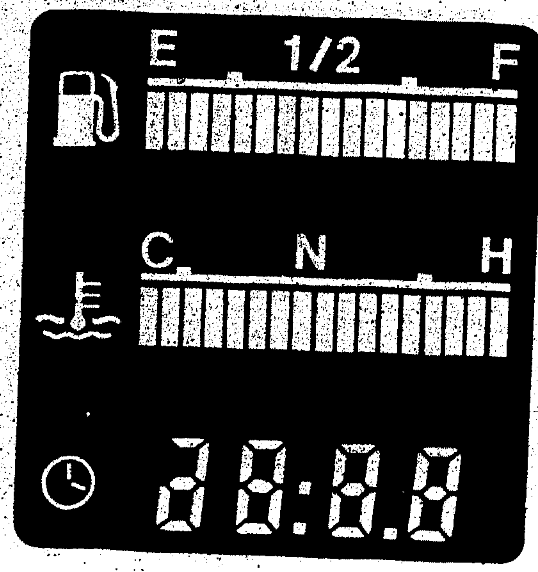
Oxygen sensor - time to replace

Fasten seat belts

Fault in engine electrics (optional extra)

Shift-up indicator (optional extra)

Switch lights ON (see 8.3).




## 7. Right-hand display panel

### 7.1 Fuel gauge

Display in form of pointer
2 segments surround the current reading
Maximum display ≘ 60 l

| | |
|---|---|
| < approx. 7 l | The 2 left-hand segments are lit; the gas pump symbol flashes. |
| < approx. 3.5 l | When all segments are off, the gas pump symbol flashes. The on-board computer moves to "fuel range" mode and shows "E" (for EMPTY) until the warning is acknowledged at the on-board computer reset button. |

## 7.2 Coolant temperature gauge

Display in form of pointer.
Segments surround the current reading.
At greater than approx. 120°C the 4 right-hand segments flash.
The transition from the 2 left-hand segments (C) to the 3 left-hand segments (C - N) is at approx. 51°C.

## 7.3 Time of day

Digital display, according to the selected system of dimensions in 12 hr or 24 hr mode:
USA : 12 hr mode (1 : 00 - 12 : 59)
Canada : 24 hr mode (0 : 00 - 23 : 59)

Time is displayed with ignition off by pressing the on-board computer reset button.

Time is set by means of the on-board computer rockers and reset button (see 8.7).

# 8. Details:

## 8.1 Segment and display test

When the ignition is switched on with the vehicle stationary, all segments are energized for a period of approx. 3 sec.
Exceptions to this are the speedometer display and the on-board computer display; during the 1st sec. a "2" is indicated in the left-hand digit, and then a "1".
When driving off, the test is broken off as of 5 km/h or 3 mph.

## 8.2 Brightness control for instrument cluster

The brightness of the display is electronically controlled as a function of the ambient brightness. In addition, the driver can control the brightness within certain limits by means of the control (4).

## 8.3 Switch lights ON

After switching on the ignition, the driver is requested to switch the lights ON if the outside brightness has fallen below a certain level.
The indicator lamp flashes; it goes out after a distance of approx. 65 m or when the driving lights have been switched on.

## 8.4 Selection of system of dimensions (USA/Canada)

Press right-hand on-board computer rocker (BCr) for approx. 2...3 sec until MPH (USA) or km/h (Canada) flashes in the speedometer display.
On-board computer display panel goes dark immediately.
Renewed brief pressing of BCr causes switchover to the other system of dimensions.
When the desired system of dimensions flashes, briefly press left-hand on-board computer rocker:

On-board computer display panel lights up, selection procedure is completed.

## 8.5 Selection of odometer/trip meter

Press left-hand on-board computer rocker (BC 1) for approx. 2...3 sec. until MLS/km or TRIP-MLS/km flashes on the center display.
On-board trip computer display panel goes dark immediately.

Renewed brief pressing of BC 1 causes switchover to the other function.
When desired function flashes, briefly press right-hand (!) on-board computer rocker:
 On-board computer display panel lights up; selection procedure is completed.

## 8.6 Trip meter reset

See also "Selection of odometer/trip meter":
With "TRIP" flashing, press on-board computer reset button for approx. 2 sec.; then briefly press BCr.

## 8.7 Setting the time

Press right-hand on-board computer rocker (BC r) for approx. 4...5 sec. until hours display flashes.
On-board computer display panel goes dark immediately; after approx. 2 sec. system of dimensions mode flashes.

The hours can now be set at the on-board computer reset button:

 Brief pressing: display advances one at a time
 Long pressing: automatic advance of display at 2 Hz

Renewed brief pressing of BCr causes the minutes display to flash.
The minutes can now be set just like the hours; by pressing the reset button, the seconds start at zero.
When the desired time has been set, briefly press left-hand on-board computer rocker.
 Time no longer flashes
 On-board computer display panel lights up
 Time-setting procedure is completed.

## 8.8 MIN/MAX selection for scope of display

Switchover is by pressing the MIN/MAX button (4):

MAX → MIN, stage 1 : Briefly press button
MAX → MIN, stage 2 : Press button for approx. 2 sec.
MIN 1/2 → MAX : Briefly press button.

If a warning has to be given, there is an automatic switch-back to the full display.

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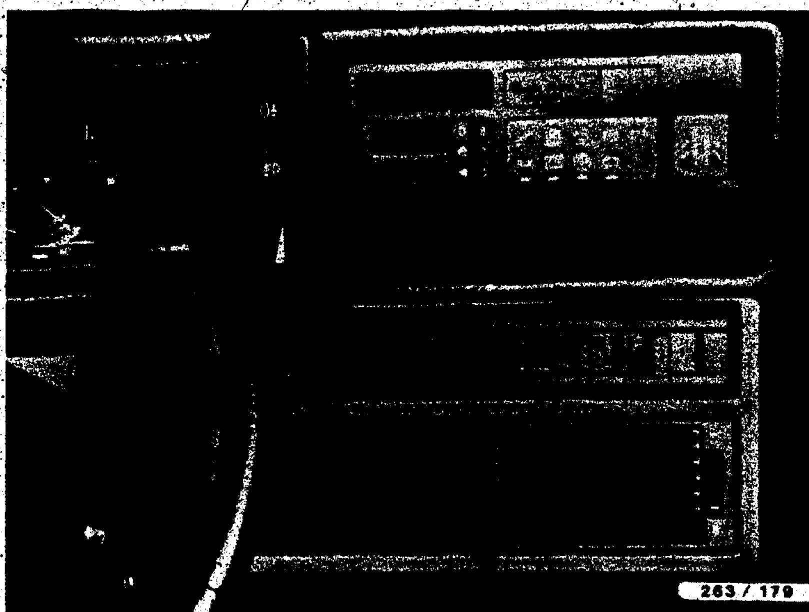
Register tab 12 Systems
File Identity VDT-I-KFZ / 7 En
06.1986

NEW SYSTEM

TRIP COMPUTER

Alfa Romeo Alfa 75




As of September 1985, Alfa Romeo is supplying the Alfa 75 vehicle (successor to Giuiletta) with trip computer (TP).

The trip container contains activation and evaluation electronics.

It is built into the dashboard (see illustration).

The following signals are used as measured quantities:

- Resistance of the NTC resistor in temperature sensor (Bosch) built into front wheel well.
- Injection signal ti with L-, LE, LE2-Jetronic, and Motronic.
- Consumption signal from fuel-consumption sensor (non-Bosch) on carburetor vehicles.
- Speed signal from odometer frequency sensor (Alfa).
- Tank-sensor voltage (Alfa).

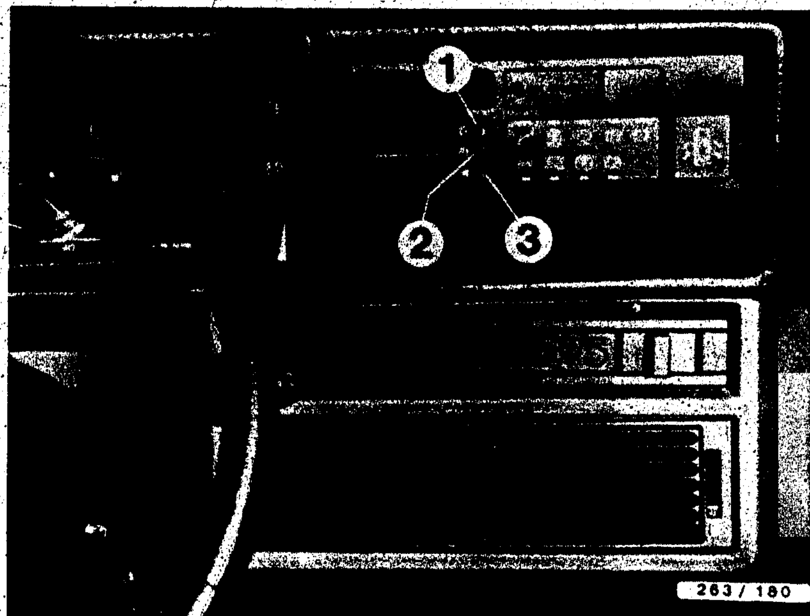
While the ignition is off, the time of day is shown on the trip computer.

The operating buttons on the trip computer are inoperative and display illumination is switched off.

The following functions can be called in sequence when ignition is switched on by pressing button 3 on the trip computer:

- Present rate of consumption

  Display in l/h under 20 km/h
  Display in l/100 km over 20 km/h




1 = Reset button
2 = Clock-time button
3 = Function-select button

- <u>Average fuel consumption</u>

  Display in av. l/100 km

- <u>Average speed since last pressing reset button (1)</u>

  Display in av. km/h

- <u>Range</u>

  Display in km.

- Stopwatch

Can be stopped with reset button (1), set to 0, and restarted from 0.

Stopwatch display (only driving time with ignition on)

| Time measured | Displayed characters indicate: | | | |
|---|---|---|---|---|
| up to 10 min | min | sec | sec | 1/10 sec |
| up to 60 min | min | min | sec | sec |
| up to 100 h | hrs | hrs | min | min |
| above 100 h | hrs | hrs | hrs | hrs |

- Outside temperature

Display in °C

While ATC function is being displayed, the clock time can be displayed by pressing the priority button (clock symbol). Pressing again on the function-select button will cause a return to the previously-displayed function.

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# Complaints concerning leaks on headlamps 0 301 014.. for Ford



VDT-BME 611/29 and VDT-I-301/100 of 3.75 should be destroyed!

In the case of the headlamps 0 301 014.. for Ford Consul and Granada there has recently been an increase in the number of complaints reported and warranty claims asserted due to leaking headlamps or misting up of the lens. In most cases the warranty claim was not justified as it was clearly established that the leak was caused either by incorrect fitting of the side-marker lamp socket or hood, or by reuse of old hoods or sockets.

The side-marker lamp socket and hood are not supplied with our headlamps but are supplied by Messrs. Ford. The hoods and side-marker lamp sockets have thus been modified because of the leaks which have occurred.

Side-marker lamp socket: fitted in headlamp from October 1973 to November 1976. The socket is made of soft plastic. Ford No. 72 GG-13728-BA.

Side-marker lamp socket with bayonet-type connection: fitted in headlamp from December 1976. The housing on the headlamp was appropriately modified. Ford No. 1516315.

Note: On headlamps from FD 632 (Dec. 76) it is essential to use a side-marker lamp socket with bayonet-type connection (Ford No. 1615315).

Latest version of hood

consists of plastic with vent hole and rubber seal ring for sealing at the reflector. Fastening is carried out by means of tensioning brackets on the headlamp. When fitting the hood it is important to ensure that the vent hole is pointing downwards. Furthermore, whenever a headlamp is replaced, the side-marker lamp socket and hood should also be replaced.

Testing the headlamps for leaks

Before being recognized as a warranty case, the headlamp must always be tested for leaks, using the following procedure:
The headlamp which has been removed is immersed for approx. 2...3 minutes in a water bath, to which a rinsing agent or similar has been added, so that the side-marker lamp opening is approximately 5 mm above the water level. If water penetrates between the lens and the reflector or at the rivet points then the warranty claim is justified.

Warranty claims

The warranty claim cannot be recognized as justified, nor can a fair-deal arrangement be reached, in the case of leaking headlamps where the cause is ascertained to be the side-marker lamp socket or hood. Such customers are to be referred to Messrs. Ford.

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# New Product



0 307 550 900

VDT-I-307/1 B

10. 1977

## Headlight vertical aim control system (Hydromechanical hand setting) fitted to Porsche vehicles Type 928

### 1. General

When the luggage compartment is loaded and the fuel tank full the inclination of the headlamp beam is altered with the result that oncoming traffic may be dazzled (increased accident risk). With the headlight vertical aim control system the legally prescribed inclination of the headlamp beam can be reset to exclude the possibility of dazzle.

### 2. Construction

The hand setting device is a closed hydromechanical system with two separate heads of liquid.

The system is supplied full; the length of the liquid lines and the adjustment travel are matched to the particular vehicle.

The system consists of:

Adjusting device to the left hand side of the driver's seat (hand setting device with rotary knob), 2 aim control elements and 2 hoses.

### 3. Operation (Fig. 1 and 2)

According to the vehicle load the driver adjusts the rotary knob of the hand setting device. When the rotary knob is turned the double piston is shifted via a spindle. The displaced liquid passes through the hoses into the aim control elements and there shifts the pistons. The pistons of the aim control elements are connected to the headlight reflectors via ball and socket joints.

The primary pressure (approx. 2 bar), which is decisive also for the headlamp steadying forces, is produced by the helical compression springs in the aim control elements. For the purposes of temperature compensation plastic hoses are used which are filled with a mixture of ethylene glycol and water.

### 4. Headlamp aiming

For further important hints on headlamp aiming see Motor Vehicle Service Information VDT-I-POR 009 B.

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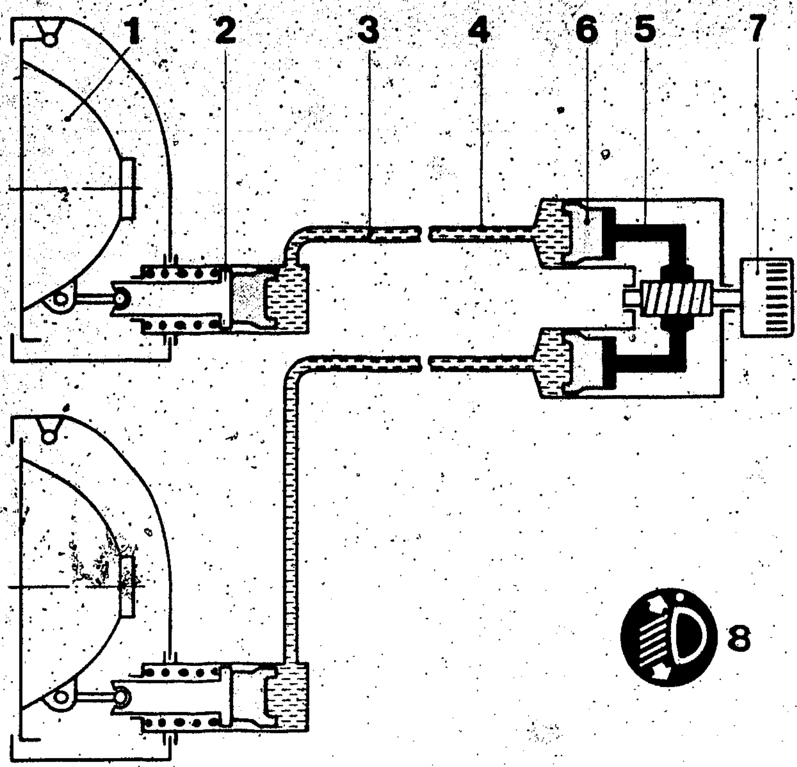
Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung

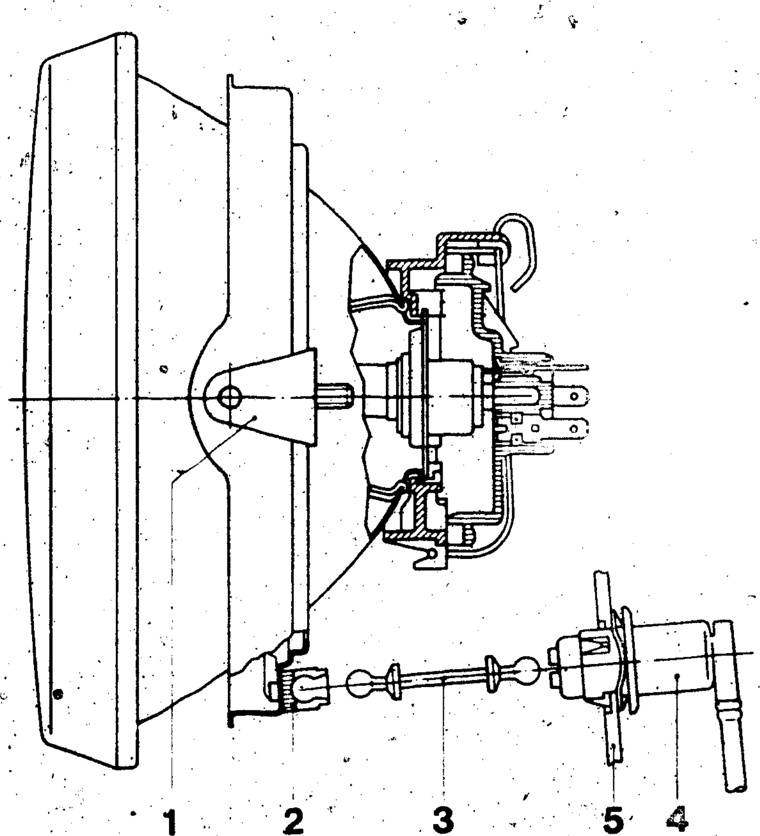
**Hydromechanical hand setting**




1 = headlamp
2 = aim control element
3 = liquid
4 = plastic hoses
5 = hand setting device
6 = cup seal
7 = rotary knob
8 = rotary knob symbol

Fig. 1

**Headlight vertical aim control system on a compact headlamp**




1 = central support
2 = clamp
3 = spacer pin
4 = aim control element
5 = holding bracket on vehicle body

Fig. 2

# New Product



0 307 6 ..
## Headlight vertical aim control
(Vacuum hand adjustment)
fitted in Mercedes-Benz vehicles
type W 116.020 (280 S) to W 116.033 (450 SEL)

### 1. General

When the luggage compartment is loaded or when the tank is full the extra weight causes the angle of the headlamp light beam to change, thereby dazzling oncoming traffic (increased risk of accident). The headlight vertical aim control enables the legally prescribed angle of the headlamp light beam to be reset so that no dazzling occurs.

### 2. Construction

The hand adjustment system consists of a control switch, vacuum hoses and two control elements (switched parallel) on the headlights.

Energy is stored in an approx. 0.4 l container which is connected to the intake manifold via a non-return valve.

### 3. Function (Fig. 1)

Several lock-in positions are possible with the control switch. These positions are matched with the most frequently occurring loading conditions of the vehicle.

By moving or turning the adjusting wheel on the control switch a vacuum (i.e. control pressure) occurs. This control pressure is used for the control elements and is generated by a double seat valve. The symbol illumination on the control switch is created by a fiber optical waveguide.

The control elements are shaped like ordinary aneroid boxes. The helical compression spring is fitted in the pressure chamber. When the control pressure (vacuum) increases, the piston is pulled in. When the control pressure decreases, the piston is pushed out.

### 4. Design

The control switch is fitted into a rectangular recess in the instrument panel. It is secured by leaf springs at the side.

The control elements are fixed to the headlights by means of a bayonet socket. The pistons have ball sockets for the linkages. The linkages connect the control element pistons with the reflectors.

### 5. Headlight adjustment

For further important instructions for the adjustment of headlights and the testing of the headlight vertical aim control see Motor Vehicle Service Information VDT-I-MB 024.

### 6. Service parts

Control and supply lines, the container and the non-return valve are Mercedes-Benz original service parts.

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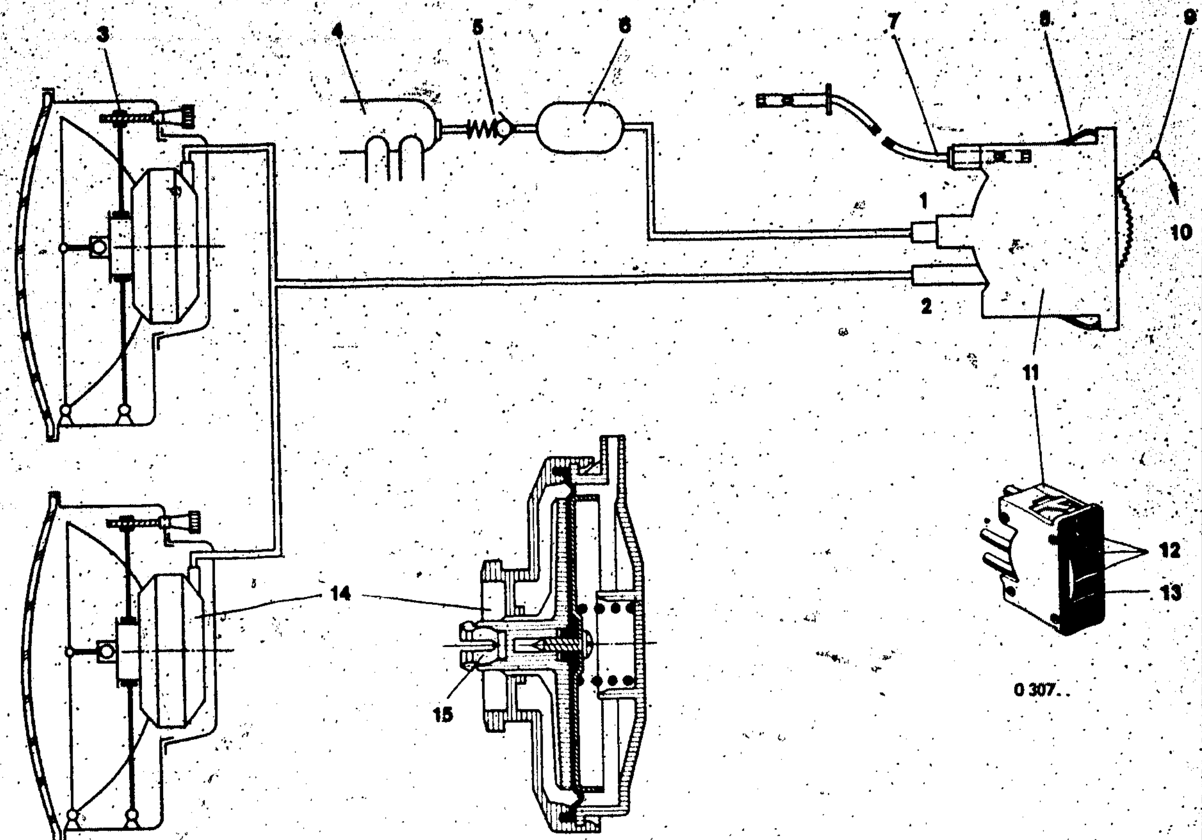



Fig. 1

1 — Supply line
2 — Control line
3 — Basic setting
4 — Intake manifold
5 — Non-return valve
6 — Supply container
7 — Fiber optical waveguide for symbol illumination
8 — Leaf spring
9 — Lock-in position
10 — Direction of movement
11 — Control switch
12 — Lock-in position
13 — Limit of travel
14 — Control element
15 — Control piston

# NEW PRODUCT

# HEADLIGHT LEVELING CONTROL 0 132 008 3..

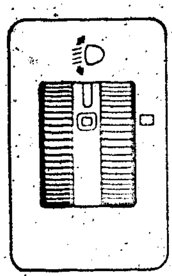
Electromechanical manual adjustment

## General

With the trunk loaded and the fuel tank full, the rear end of the car is nearer the road surface than usual with the result that the headlamp beam points upwards and dazzles oncoming traffic (increased danger of accident). Using the headlight-leveling control, the angle of the headlamp beam can be readjusted to comply with legislation.

## Design

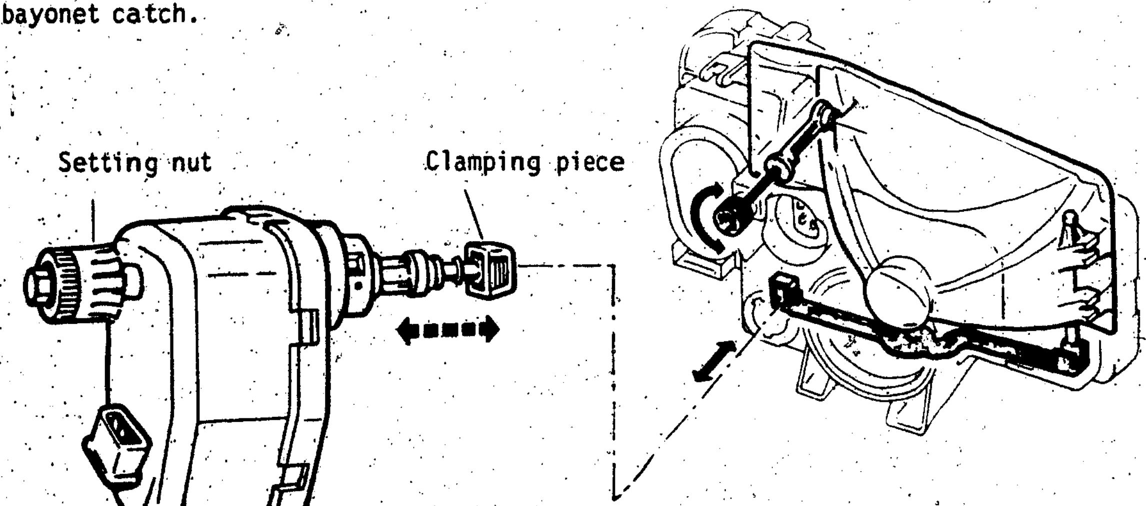
The hand, or manual, adjustment comprises a headlight-leveling adjuster (setting wheel) and two actuators with servomotors at the headlamps.



Headlight-leveling adjuster

## Construction

The headlight-leveling adjuster (non-Bosch product) is installed in the dashboard. The actuators are fitted to the headlamps by means of a clamping piece and a bayonet catch.




Actuator with servomotor

Headlamp with clamping-piece jaws

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The electromechanical actuators and the manual two-stage adjusters are fitted with clamping pieces of identical size. They can, therefore, be interchanged with each other.

## Function

Depending upon the vehicle loading, the headlamps can be adjusted between two end stops using the headlight leveling adjuster.

Position 0: Basic position, and
Position 2: Headlamps pointing downwards.

The adjustment is infinitely variable.

The required-value voltage for the sensor is set by means of the setting wheel of the headlight leveling adjuster.
The actuator delivers a voltage (actual voltage) which is dependent upon the headlamp position.
The electronic circuitry incorporated in the actuator compares the actual and the required voltages. The inclination of the headlamps is then altered according to the voltage difference.

The first headlight-leveling controls of this type are installed in the Audi 200 models as an optional extra.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK).

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# Kundendienst KH

## Technische Mitteilung



C EM
VDT-BEE 812/1 B 29
< VDT-I-290/1 B >
Edition 9.1974
Translation of German edition of 26.6.1974

## Neues Erzeugnis

0 290 004 500
Screening Cover for Ignition Distributor

1. Properties

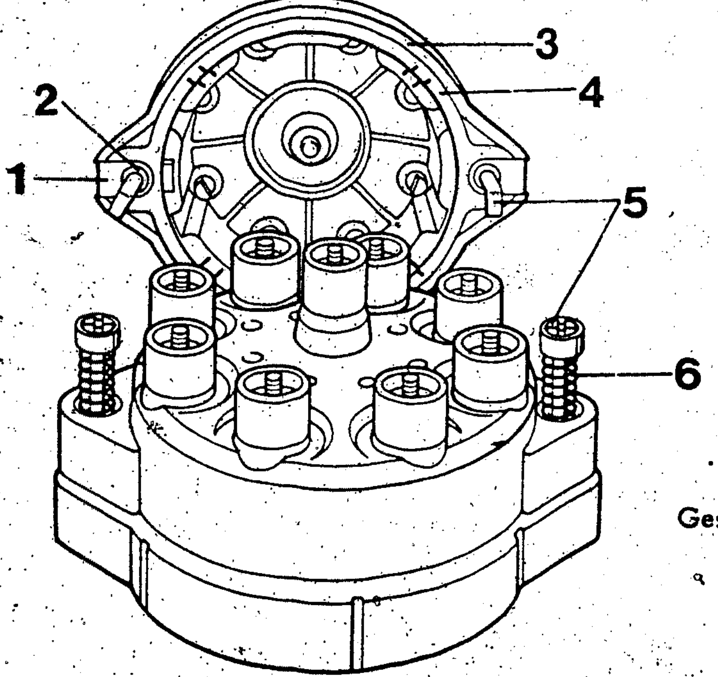
The screening cover for the ignition distributor

- improves intensified interference suppression
- prevents dirt or water from adversely affecting the ignition voltage (i.e. dust, oil residues, encrusted salt etc.)
- due to thermic effect (air cushion) it affords greater security against the formation of condensation water in the distributor.

2. Construction

This ignition distributor screening cover is made of electrically-conductive plastic and replaces the plastic cover and the metal-coated distributor cap which have been used up until now in Mercedes-Benz 8-cylinder ignition distributors.

The screening cover is shaped in such a way that it forms a watertight seal around distributor cap and cable insert towers. A certain gap is maintained between the screening cover and the distributor cap. The resulting air cushion prevents the warm air trapped in the ignition distributor from cooling down too quickly, and this gives greater security against the formation of condensation water in the distributor cap. The ground connection from the distributor housing to the screening cover ensues via both retaining pins, springs, rivets, contact plates and a metal ring (not shown) which is injection-moulded into the base of the protective cover.




1 = contact plate
2 = rivet
3 = screening cover
4 = distributor cap
5 = retaining pin
6 = spring

ROBERT BOSCH GMBH
Geschäftsbereich K-Ausrüstung
Handel
Kundendienstschule

# Fully-screened spark-plug connectors 0 356 350 013 and . . 014

The fully-screened additional unit 1 357 030 002 has been developed to provide full-screening of partly-screened cornered spark-plug connectors. This unit enables spark-plug connectors 0 356 351 023 to 035 to be fully screened when used with non-screened high-tension ignition cable and by-the-yard interference-suppression braiding obtained locally.

The existing fully-screened spark-plug connectors 0 356 350 013 and 014 will not therefore be available any more.

With future orders please recommend the more economical follow-up design, consisting of the partly-screened spark-plug connector with the fully-screened additional unit.

| Old | Spark plug | Connection | New |
|---|---|---|---|
| 0 356 350 013 | W | M4 | 0 356 351 031<br>+ 1 357 030 002 |
| 0 356 350 014 | M | M4 | 0 356 351 028<br>+ 1 357 030 002 |
| | W | ISO | 0 356 351 032<br>+ 1 357 030 002 |
| | M | ISO | 0 356 351 033<br>+ 1 357 030 002 |

BOSCH Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung.

# New Product

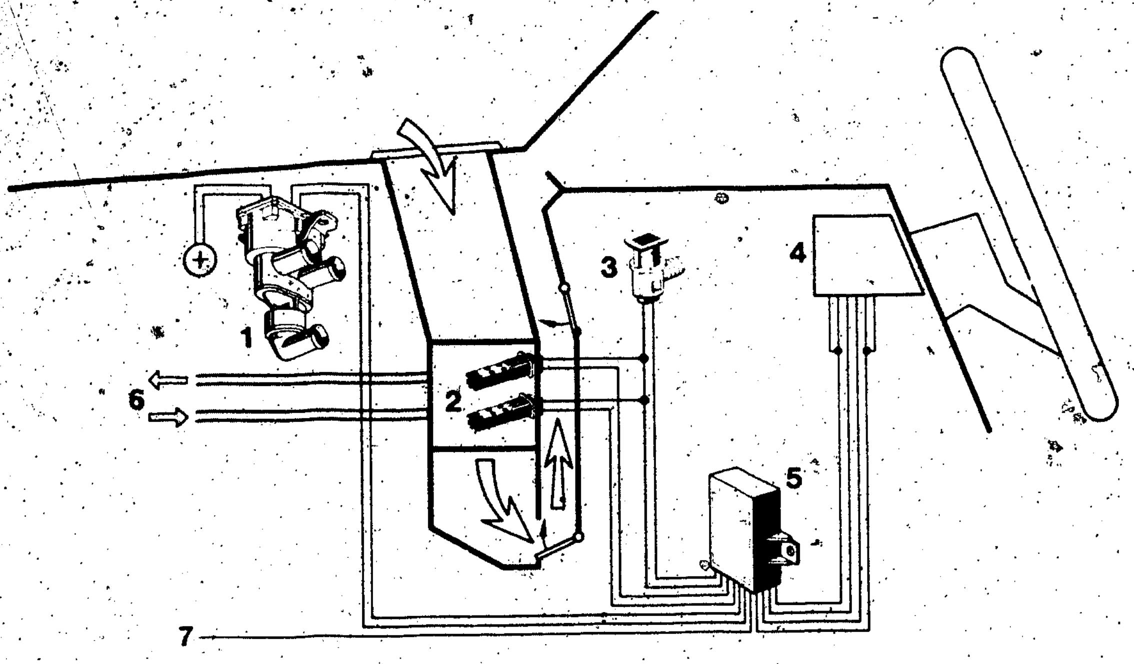


ELECTRONIC AUTOMATIC AUTOMOTIVE HEATING SYSTEM



## General

In order to increase comfort and safety, a system has been developed for controlling the passenger-compartment temperature in vehicles. An electronic control unit monitors the passenger-compartment temperature and the heat-exchanger temperature by means of a series of temperature sensors. Its output signal is used to control a solenoid-operated valve (hot-water valve) which, in turn, varies the water flow-rate through the heat exchanger of the heating system.




1 - Hot water dual valve
2 - Sensor in the heat exchanger
3 - Passenger-compartment sensor
4 - Operating controls (setting required value)
5 - Temperature regulator
6 - Coolant circuit
7 - Connection for hot-water pump

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J13

## Individual components

2 hot-water valves

2 set-value adjusters (Potentiometers)

2 sensors for the heat-exchanger halves

1 sensor for the passenger compartment

1 temperature regulator (with or without a connection for a hot-water pump as required)

## Principle of operation of the complete system

After completion of the rapid, automatic, heating-up process, the temperature remains for the most part constant independent of the driving mode and the outside conditions. Outside temperature changes and any intended changes in the setting of the operating controls whilst driving, cause a slight "swing" of the blower-output temperature either above or below the existing interior temperature. This results in the required temperature being reached rapidly.

In comparison to conventional systems with manual adjustment of the blower-output, this system offers the following advantages:

Rapid warm-up

Rapid reaction to changes in the required-temperature setting

Completely independent of air-flow both from the outside and to the outside, e.g. the temperature is maintained during sudden stops, whilst stationary, in cases of changes in the water flow-rate and the air flow-rate (due to vehicle speed and blower speed), and in case of cool-off due to rain and fresh-air supply. The temperature is also maintained when the sun shines on the vehicle.

Extremely small deviation of the actual value from the set value even with sudden changes in load.

The possibility of extension to full air-conditioning.

## Control function

### Temperature control driver's side/front-passenger side

With this system, which will be introduced in Mercedes-Benz passenger cars, the temperature can be set individually for both the driver's side and the front-passenger side as is normally the case with Mercedes-Benz.

Such a system is not unproblematical, because the driver's side and the front-passenger side are not divided by a "wall" but are coupled together by the common interior of the vehicle and by a common passenger-compartment sensor.

The problem was solved in the following manner: with different temperature settings a passenger-compartment temperature in the middle of the two settings is maintained but the blower-output temperature in the respective footwells is different and in accordance with the setting in question for left and right.

## Passenger-compartment sensor

The passenger-compartment sensor must register temperature deviations as quickly as possible. In order to put this into practice, the sensor is situated in a stream of air drawn in from the passenger compartment by a pump operating on the air-jet principle. The pump projects into the stream of air drawn in by the blower, and its principle is based on the fact that fluid or gas for instance which is forced past a nozzle is capable of pulling another medium along with it. Using this principle means that the passenger-compartment sensor is not subiect to the radiated heat from the parts around it.

## Hot-water valve

2 hot-water valves (solenoid-operated valves) are located in a common plastic housing and operate with servo-assistance. Due to the fact that when voltage is not applied to these valves they are open, this means that warm water accumulates in the heat exchanger when the vehicle has been switched off. This is due to the thermosiphon effect.

This thermosiphon effect means that water circulation takes place without a pump being in operation, because hot water rises and cold water falls.

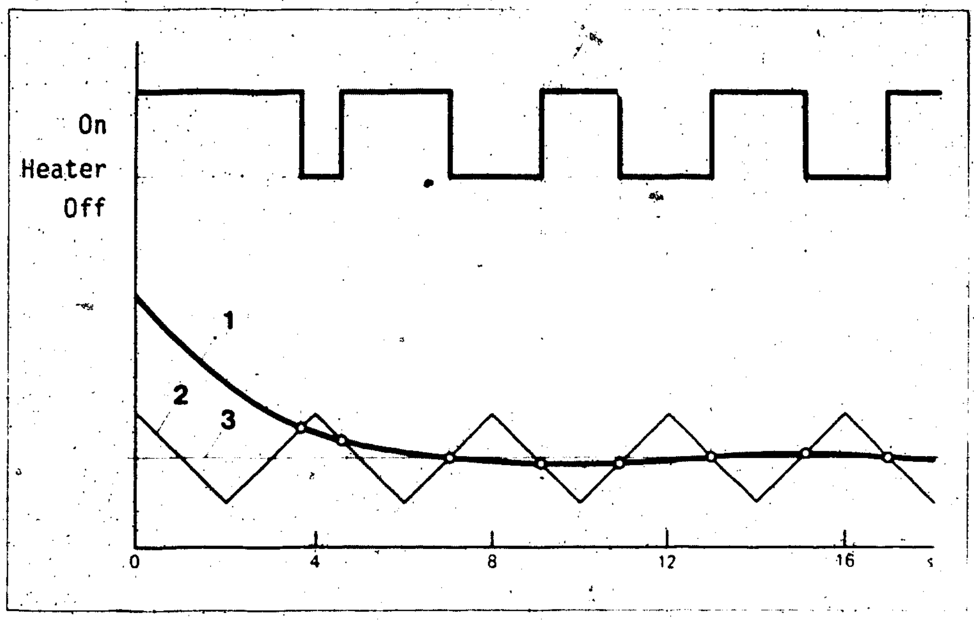
When starting an engine that is still warm though, this leads to an unpleasant blast of hot air in the footwell due to the fact that there is still hot water in the heat exchanger. In order to prevent this, a non-return valve is fitted in the hot-water valve.

When closed, each solenoid-operated valve has a power consumption of approx. 12 W.

## Please note

Anticorrosion oil must not be added to the coolant because this will adversely affect the operation of the solenoid valves. Antifreeze which already incorporates an anticorrosion agent can of course be used.

## Cold-start control




1 - Control voltage (actual value - set value difference)
2 - Reference voltage
3 - Set-value voltage (pickoff voltage at the potentiometer)

Due to the sawtooth-like reference voltage generated by the temperature regulator, the solenoid valves are opened and closed in a constant 4 s on/off cycle. The open time of the solenoid valve depends upon the particular deviation from the temperature set-value in question. Variations in temperature are not noticed because of the rapid on/off pulse sequence.

## Operation

The heater blower is always to be switched to the lowest speed. If the blower output temperature is found to be too cool in the footwell (as a result of low heating power in the heat exchanger), this can be compensated for by adjusting the air louvre in the dashboard. The temperature regulator responds to the resulting cooler temperature by increasing the temperature of the blower output. The "temperature-layer" effect due to the introduction of fresh air (cool head, warm feet) is particularly pleasant in the transitional periods (Spring and Autumn).

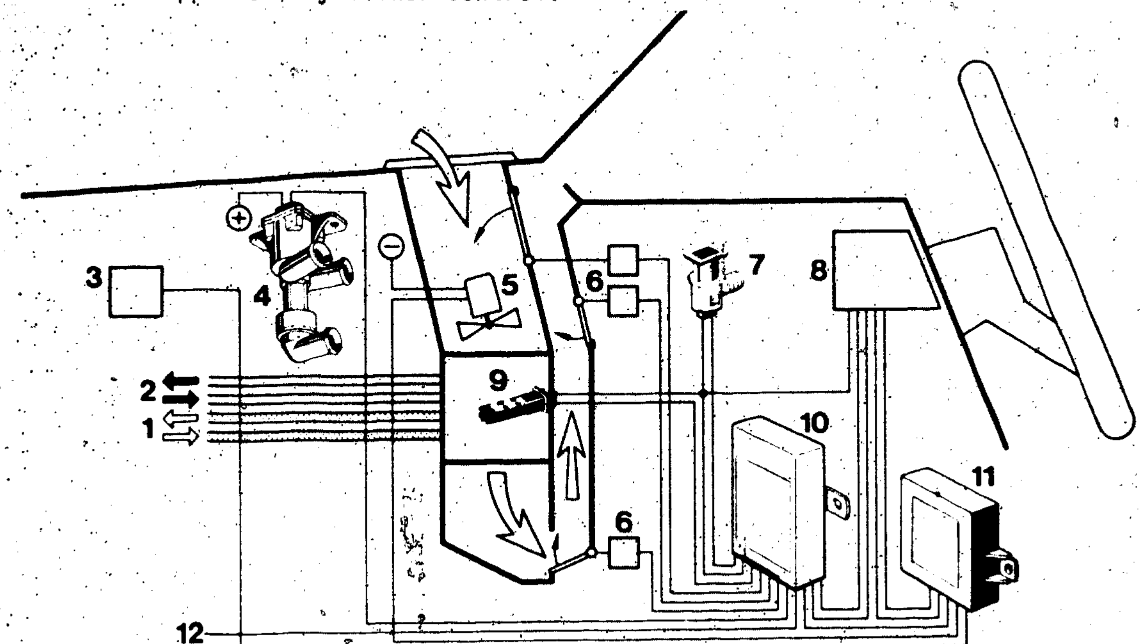
# New Product

ELECTRONIC AIR-CONDITIONING SYSTEM
for vehicles
with supplementary BLOWER CONTROL



## General

The system is based on a simple automatic heating system which is described in principle in the Technical Bulletin "New Product" VDT-I-141/1 En. Separate air-conditioning for the driver's side and the front-passenger's side is not incorporated. The automatic air-conditioning system has, in addition to the automatic heating system, a refrigerating unit and controls the air-flap actuation as well as a supplementary blower control.




1 - Engine hot-water circuit
2 - Engine cold-water circuit
3 - Ballast resistors
4 - Hot-water valve
5 - Blower motor
6 - Flap actuation drive
7 - Passenger-compartment sensor
8 - Operating controls (setting required value)
9 - Heat-exchanger sensor
10 - Temperature regulator
11 - Blower-control unit
12 - Connection to the magnetic coupling for the refrigerant compressor

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## Individual components

2 sensors (passenger compartment and heat exchanger)

1 set-value adjuster

1 ice-up thermostat

1 hot-water valve

2 control units (temperature regulator, blower control)

1 compressor with magnetic coupling

Flap actuation drives

## Control function

The automatic air-conditioning system is comprised of an air conditioner with refrigerant system and heat exchanger. The refrigerant-system compressor runs continuously until the permanently set evaporator temperature (ice-up safeguard) has been reached, this lies slightly above 0 °C. The required passenger-compartment temperature is achieved by applying heat from the normal vehicle heating system in "opposition" to the evaporator temperature. This has the advantage, that the air in the vehicle is always dehumidified to a comfortable value and the windows and windshield are prevented, for the most part, from fogging-up.

The control is only applied to the heating system as described in VDT-I-141/1 En. In addition to the automatic heating system, the air-conditioning system also incorporates automatic blower control and automatic setting of the air-distribution flaps.

## Blower control

### Principle of operation of the complete system

The more the temperature deviates from the set value, the more the blower speeds up. An output signal from the temperature regulator is applied to the blower-control unit which then switches in one of the four blower-speed stages. These stages are selected by means of resistors.

Incorporated in the system is a facility which causes delayed speed-up of the blower through the four stages in order to prevent it immediately operating at full speed when the ignition is switched on and the passenger-compartment temperature deviates considerably from the set value. The temperature is controlled solely by controlling the heating output, this requires a certain minimum air flow. This air flow is automatically guaranteed by a basic blower speed.

In addition to the automatically selected blower-speed stages, two further blower-speed stages can be selected manually:

Max. blower speed (high)
Min. blower speed (low)

By selecting one of these blower-speed stages it is possible to bypass the automatic blower system.

### Function of the blower-control units

A ballast-resistor chain is connected in series with the blower motor. This chain of 4 resistors can be bridged in stages by 4 relays. This means that 5 different blower speeds can be selected.

After the supply voltage has been switched on, a timing element ensures that all relays are not supplied with voltage for about 7.5 s, during this time the blower remains switched off. After this period has passed, the blower speed is determined by the output signal from the temperature regulator (this is the input signal at the blower-control unit) and the switch position high/low.

Flap actuation, air distribution center nozzle/footwell

For reasons of comfort, no cold air is applied to the footwell and no warm air leaves the center nozzle. Apart from this, the switch-over process is evened out somewhat by means of an "overlap" period when both flaps are open. Independent of these functions, if the vehicle is very cold it is warmed-up via the footwell, and if it very hot it is cooled-down via the center nozzle.

The switch-over from the footwell to the center nozzle as a function of the blower output temperature takes place by means of solenoid valves and vacuum units on the air-distribution flaps.

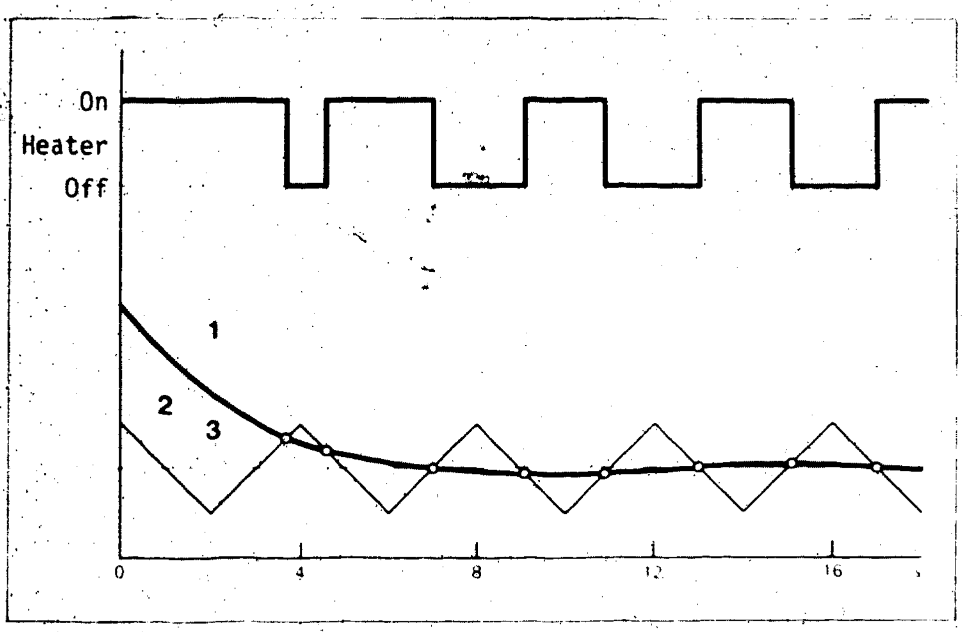
Flap-actuation fresh air/air circulation

The refrigerating capacity is insufficient for cooling the vehicle when it is very hot and the outside temperature is high. For this reason, the system must change from the fresh-air mode to the air-circulation mode. The signal to trigger this change-over is also delivered by the temperature regulator. The air-circulation mode can only be used when the compressor is operating. The actuation of the air-distribution flaps is by solenoid valves and vacuum units.

Control of the hot-water valve

During normal operation, the hot-water valve is switched on and off at given intervals. The hot-water valve only remains on permanently when the temperature selected is much higher than the temperature prevailing in the vehicle. It is changed back to the on/off mode as soon as the difference between the required temperature and the actual temperature has reached a given value.

Cold-start control




1 - Control voltage (actual value - set-value difference)
2 - Reference voltage
3 - Set-value voltage (pickoff voltage at the potentiometer)

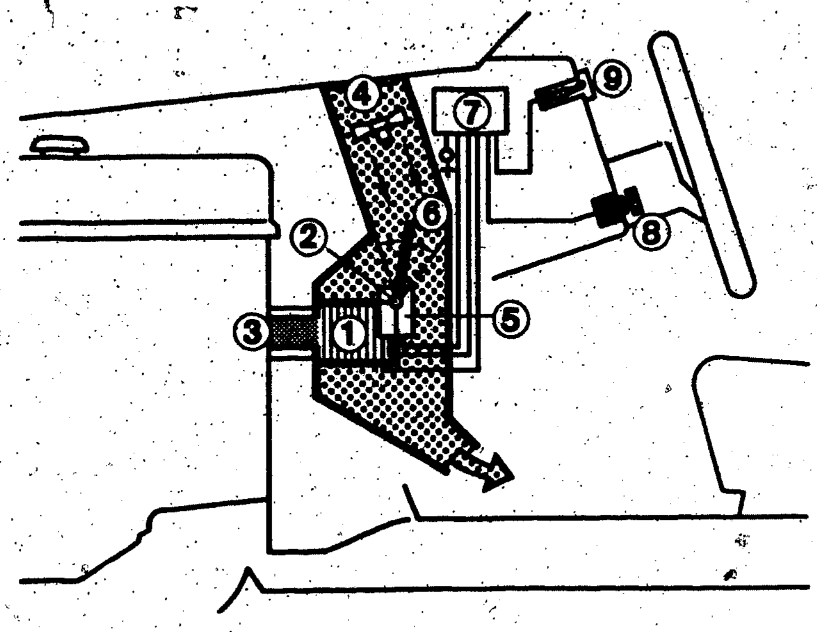
After cold starting and also after changes in the required-value settings, the required passenger-compartment temperature is reached as rapidly as possible by slightly increasing the blower-output temperature.

New product





AUTOMATIC AIR-BASED HEATING CONTROL




1 = Heat exchanger
2 = Potentiometer
3 = Coolant
4 = Fresh air
5 = Electric-motor flap control unit
6 = Mixer flap
7 = Electronic control unit
8 = Temperature selector
9 = Passenger-compartment temperature sensor

Technical Bulletin



BOSCH
Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.

General

The "automatic air-based heating control" keeps constant the temperature set at the temperature selector by moving the mixer flap.

Construction

The "automatic air-based heating control" consists of electronic control unit, electric-motor flap control unit, temperature selector and passenger-compartment temperature sensor.

Operating principle

In the electronic control unit the setpoint temperature set at the temperature selector is compared with the actual value measured by the passenger-compartment temperature sensor.

Depending on the difference between the actual value and the set value, a servo-motor moves the heating flap, thus changing the air throughput through the heat exchanger. The position of the heating flap is fed back to the electronic control unit by a potentiometer in the servo-motor.

Depending on the date of production, some control units have a built-in time-delay circuit which causes a gradual movement of the heating flap when there is a change in the temperature setpoint set at the temperature selector.

When the ignition is switched on the time-delay circuit is bridged and the heating flap moves immediately into the preselected position.

The first automatic heating controls of this type are installed in Citroen vehicles of the CX model.

Please direct questions and comments concerning the contents to our authorized representative in your country.

ELECTRONIC CONTROL OF HEATING AND AIR-CONDITIONING

VDT-I-141/100 En
10.1982

After-sales service procedure



## Description of the system

In vehicles with automatic heating and air-conditioning, a temperature, which only needs to be set once, is held constant with the aid of heating and air-conditioning control independent of vehicle speed and engine speed.

## Users

BMW and Mercedes-Benz are the first vehicle manufacturers to offer the electronic heating and air-conditioning control from Bosch (in some cases as standard equipment, in other cases as a special fitting).

| | |
|---|---|
| BMW | for vehicles 518, 520i - 528i as from 6.1981 |
| Mercedes-Benz | for vehicles MB 200 - 500 as from 1.1980 or 9.1981 |

Bosch components used in the heating and air-conditioning control are as follows:-

| | |
|---|---|
| Control unit - temperature regulator | 1 147 328 .. |
| Control unit - fan regulator | 1 147 328 .. |
| Temperature sensor - heat exchanger | 1 147 212 .. |
| Temperature sensor - passenger compartment | 1 147 212 .. |
| Hot water valve | 1 147 412 .. |
| Hot water pump | 0 130 002 .. |
| Cooling compressor (sometimes fitted) | 0 140 903 .. |

The exact numbers of the Bosch components are listed on the the service-part microfiche EE..*.

* See microfiche EE 00 under 0 141 811 ..

The components in the cooling circuit (evaporating unit, capacitor and in some cases the compressor etc.) are not manufactured by Bosch and we do not supply them.

## Repairs/service parts

It is not possible to repair individual components (except for the cooling compressor/electromagnetic clutch). Defective parts must be completely replaced.

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Testing concept

The testing of individual parts of the system in the vehicle is carried out with the heating and air-conditioning test-adapter in connection with special system adapter cables.

Test apparatus

| | | |
|---|---|---|
| Heating and air-conditioning test-adapter | | KDHK 0001 |
| Adapter cable for heat control | BMW | KDHK 0002 |
| Adapter cable for air-conditioning | BMW | KDHK 0003 |
| Adapter for automatic heating | MB | KDHK 0004 |
| Adapter cable for automatic air-conditioning | MB | KDHK 0005 |
| Adapter cable for automatic heating and air-conditioning | MB | KDHK 0006 |

To be obtained from KH/VKD 4.

Technical documentation

Technical bulletin - "New Product " VDT-I-141/1 and 141/2
Trouble-shooting instructions and test specifications on the SIS microfiches BMW-00/E61 and MB-00/E61, .. E62, .. E63.

Training

Not necessary for the electronic parts
Necessary for the cooling circuit

Retrofitting

Retrofitting is possible in BMW vehicles in the 5-series as from date of construction 6.1981 (Retrofitting set obtainable only from BMW).
Retrofitting of the Bosch system into MB vehicles is not intended at the present time.

Guarantee procedure

Federal Republic of Germany:
Bosch components on which a claim is to be made, should be sent during the guarantee period via the relevant Bosch wholesaler for inspection to:

BüW/QSG (K4) - Robert Bosch-Str. 1, 7580 Bühl

together with guarantee claim form G 20 and delivery slip KH/VKD3 - 15333.

Other countries:
Components on which a claim is to be made should be sent during the guarantee period for inspection to the appropriate representative in your country.

# New Product

VDT-I-285/1 En

3.1981

AIRBAG AND SEAT-BELT TIGHTENER

0 285 ...

## 1. General

The passenger restraint system in use up to now, comprising the three-point seat belt fitted as series equipment, is being extended by the addition of another restraint system: the airbag and/or seat-belt tightener.

3 different system combinations are possible:

- Driver and co-driver each with airbag
- Driver with airbag and co-driver with seat-belt tightener
- Driver and co-driver each with seat-belt tightener

## 2. Construction

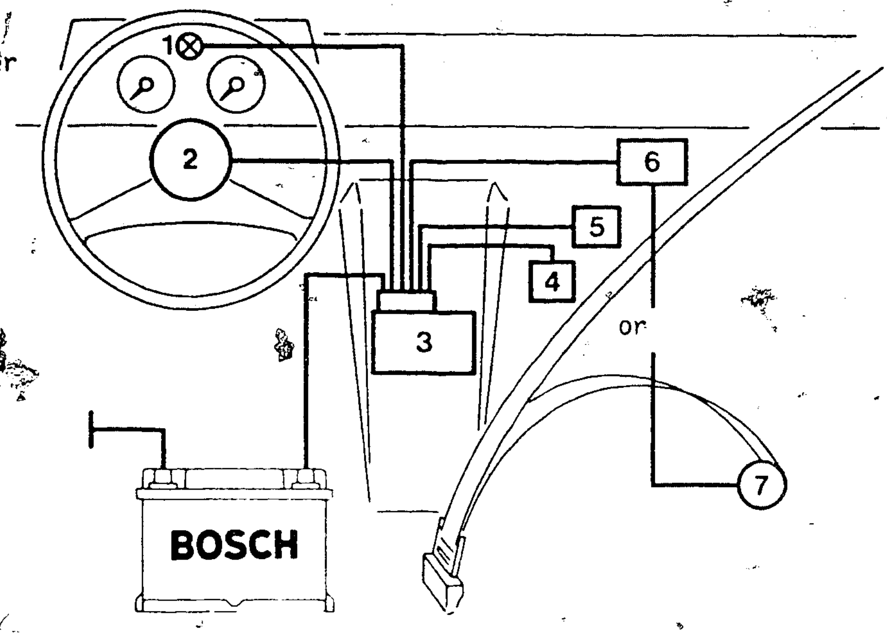
The airbag system is comprised of the following Bosch components:

- Triggering device (with acceleration sensor and system monitoring)
- Power stand-by
- Voltage transformer

Further components necessary for functioning (not included in Bosch delivery scope):

- Airbag
  Firing pellets, gas generators and air sack
- Seat-belt tightener
  Firing pellets, turbine and belt-reel

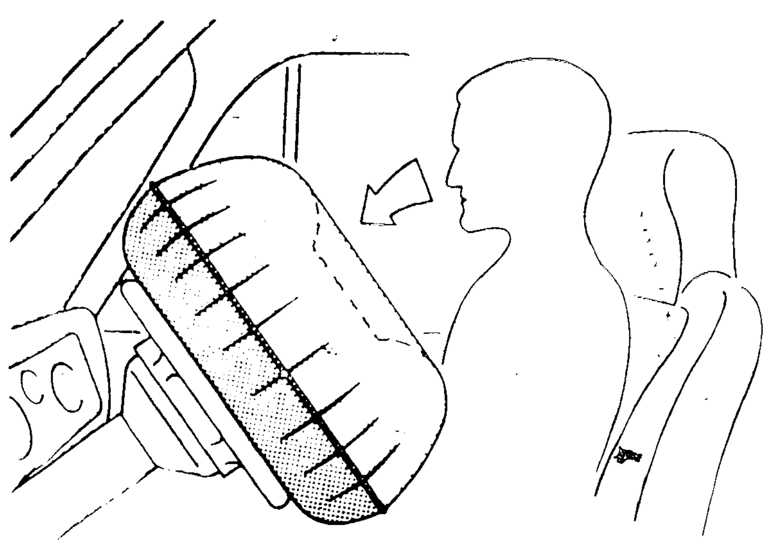
1 Check lamp
2 Driver airbag
3 Triggering device
4 Voltage transformer
5 Power stand-by
6 Co-driver airbag
7 Seat-belt tightener




3. Airbag function

The airbag is triggered when a frontal collision occurs corresponding to a frontal collision against a wall at approx. 10-11 mph (18 km/h). An electrical pulse (firing pulse) is passed from the triggering device to the firing pellets in the gas generator. This pulse detonates the solid propellant in the gas generator by means of the firing pellets. The propellant detonates in a few thousandths of a second and inflates the air sack.
The inflated airbag prevents the driver's (co-driver's) chest and head being injured by striking objects such as the steering wheel etc.

Within a tenth of a second, the inflation gas has left the air sack through bleed-slots around the side of the sack and this then collapses. Visibility to the front is possible again.



4. Seat-belt tightener - function

The triggering process corresponds to that of the airbag, with the seat-belt tightener though the propellant device forces fluid against the impeller wheel of the turbine. Due to the rotation of the turbine wheel, the roll-up shaft of the tightener is forced back and, as a result, the belt tightened until it is taut against the upper part of the body. This increases the belt's protective effect.

5. Power stand-by

If, in the case of an accident, the vehicle battery is immediately destroyed or separated from the vehicle electrical system, the operation of the triggering device and the firing circuitry is ensured by means of the power stand-by.

6. Voltage transformer

This device ensures that the full operational voltage necessary for the triggering device is available if the battery voltage drops to 4V.

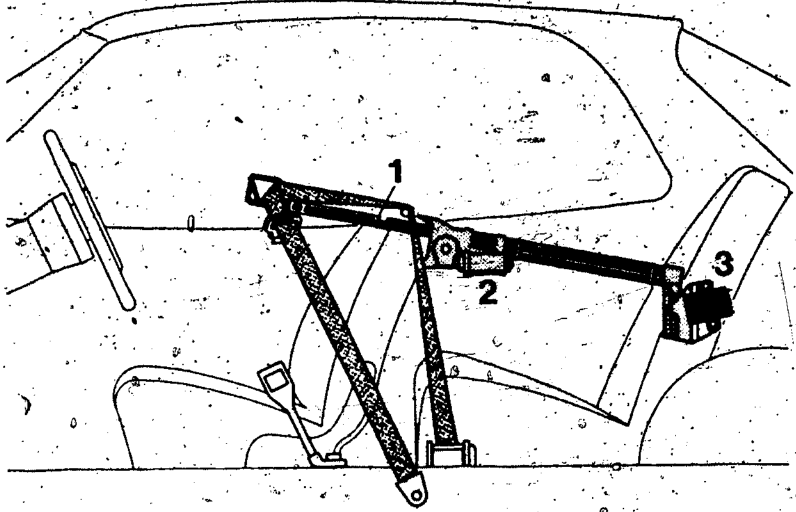
7. Check lamp

The check lamp serves for system monitoring.

This lamp lights up for about 10 s when the ignition is switched on. If the system is OK, the lamp then goes out. If the lamp either does not light up at all, or does not go out after about 10 s, then there is a fault in the system.

BELT BRINGER SYSTEM
in Mercedes-Benz 380/500 SEC
(Type C 126)






1 = Slide rod   3 = Electronic control unit
2 = Electric motor

## General

To make it easier for driver and front passenger to belt up, the belt bringer system brings the seat belts forward into a position from which they can easily be buckled (see picture).





BOSCH
Geschäftsbereich KH, Kundendienst Kraftfahrzeug-Ausrüstung.


J28

## Construction

The belt bringer system consists of electric motor, slide rod, guide rail, limit switch and control unit. The system is installed in the rear side part.

## Operating principle

After the door contacts have been actuated and after the ignition has been switched on, the seat belts are moved forward by the slide rods of the belt bringer system. After belting up (actuation of belt buckle) the slide rod retracts into its initial position. If the seat belt is not buckled the slide rod retracts with the belt into its initial position after approx. 30 sec. (offering time).
If, during its forward movement, the slide rod encounters a force (obstacle) it retracts with the seat belt as far as the rest position, but then automatically and immediately comes forward again.

## Overload protection

If the slide rod is unable to advance or retract, the belt bringer system switches off completely after approx. 15 sec.
After remedying the malfunction, the system can only be started up again by interrupting the battery voltage.

## Emergency operation

If the electrical system fails, the slide rod can be pushed back into its rest position by hand.

New Product VDT-I-335/11 En

TWO-WHEELED VEHICLE ALARM SYSTEM 11.1984

0 986 335 005

To round off the range of alarm systems, Bosch has been supplying an alarm system for two-wheeled vehicles since mid-1984.

Operating principle:

The alarm system is switched on and off by means of a key-operated switch which is integrated in the trigger box.

The alarm is triggered without delay in the event of

- raising of the vehicle stand
- switching on the ignition
- cutting of the lead to the alarm system

The alarm sounds for max. 30 sec. by means of a built-in acoustic signal generator or vehicle horn.

The intrinsic safety of the system in the event of the lead from the vehicle electrical system being cut is guaranteed by a small built-in battery.



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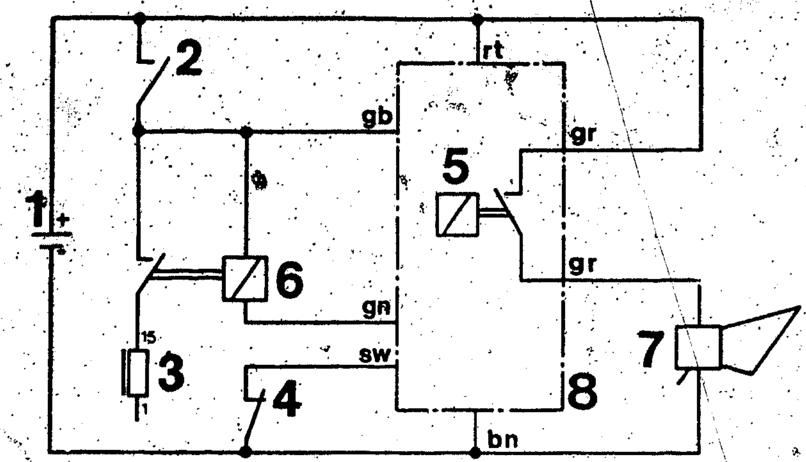
K2




1 = Battery
2 = Ignition lock
3 = Ignition coil
4 = Sensor

5 + 6 = Relay
7 = Horn
8 = Trigger box

Colours of leads:

bn = brown, gb = yellow, gn = green,
gr = green, rt = red, sw = black

Terminal diagram (see picture).

Alarm procedure:

With the system armed, the alarm is triggered without delay if:

- the position sensor opens
- the ignition is switched on
- the power supply or the lead to the position sensor is cut.

The alarm is sounded intermittently by means of the vehicle horn or the internal acoustic signal generator. Duration of alarm 20 ... 30 sec.
The alarm signal must be interrupted immediately when the alarm system is switched off with the key-operated switch.

Published by:
Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

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CAR ALARM I - 0 335 411 904 VDT-I-335/109 En

in vehicles fitted with electric radiator fan 9.1980

In vehicles with an electric radiator fan, it can sometimes happen that the fan is caused to rotate due to strong winds. The fan then functions as a generator and produces a voltage peak which, if an Auto Alarm I has been fitted and is in the primed state, can trigger this and cause a false alarm.

In order to prevent this, a commercially available 16V 47µF capacitor is to be wired between terminals 30b and 31 of the alarm relay. This results in a reduction in sensitivity at the alarm system input.

As from date of manufacture (FD) 932 = Dec. 1979, this capacitor is fitted as standard in the alarm relay.

TWO-WHEEL VEHICLE ALARM SYSTEM

0 986 335 005

Water damage

Two-wheel vehicle alarm systems are under normal service conditions protected against the ingress of water.

If, however, the vehicle is cleaned with a high-pressure jet, there may be water damage in the alarm system.

Please advise your customers of this prior to the installation of a two-wheeled vehicle alarm system.

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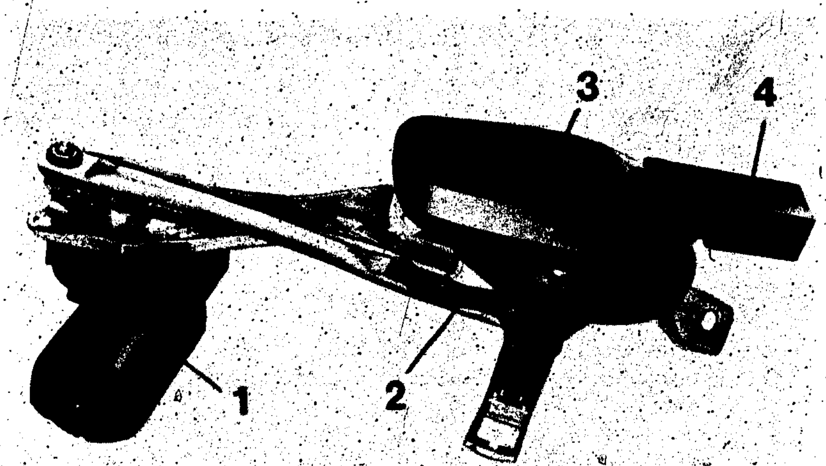
Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.


K6

New Product

# CONTROLLED SINGLE-ARM WIPER SYSTEM




1 = Wiper motor
2 = Cross-crank gear
3 = Gearhead with built-in sliding-crank drive
4 = Transport guard over wiper arm guide and sliding rod

## General

The controlled single-arm wiper system achieves a larger wiped area than the conventional single-arm wiper system.

Technical Bulletin

BOSCH Geschäftsbereich KH. Kundendienst Kraftfahrzeug-Ausrüstung.


K7

It is installed in Mercedes-Benz vehicles of type W 124 (200 to 300 E and 200 D to 300 D Turbo diesel) as of the end of 1984 and in type W 201 (190, E, D) as of the beginning of 1985.

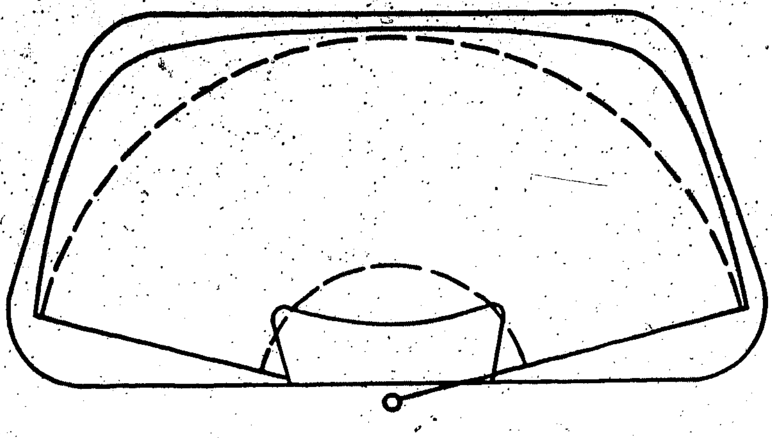
## Construction

Basically, the system consists of the wiper motor, the cross-link gear and a sliding-crank drive built into the gearhead.

## Operating principle

The rotational movement of the wiper motor is converted by the cross-link drive into the pendulum movement of the wiper arm. At the same time the pendulum movement is converted by a planetary gear in the gearhead with sliding-crank drive into a reciprocating movement of the sliding rod with wiper arm. During half a wiper cycle two full reciprocating movements of the sliding rod are produced in the sliding-crank drive.
The result is that, in addition to the pendulum movement, the wiper arm is also moved axially.

1-39414



--- Single-arm system, uncontrolled
—— Single-arm system, controlled

The sliding rod reaches its lowest point at the two reversal points of the wiper arm as well as in the center of the windshield.
The sliding rod is fully extended once between each reversal point and the center of the windshield.

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After-Sales Service Department for
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# After-sales Service

## Technical Bulletin



# New Product

**26**

Antiskid System (ABS)

Archiv / VDT

VDT-I-265/1 En
9.1979

## 1. Introduction

The growing concern with safety, triggered by ever-increasing traffic density and high accident figures, has caused manufacturers in the automotive field to take intensive measures in recent years to improve both the active and the passive safety in the automobile.

Bosch makes a decisive contribution to the improvement of active safety by means of its Antiskid System (ABS).

Most drivers are well aware of what happens when they brake sharply and the wheels lock: The vehicle cannot be steered, and there is the danger of skidding and collision. The danger increases considerably on roads which are uneven, wet, or covered with ice or sand.

Furthermore, a driver tends to panic-brake in an emergency with the result that the wheels lock almost immediately.

Here's where the ABS takes over. It prevents wheel lock-up and hence guarantees full steerability and stability during the braking process.

Furthermore, it achieves the optimum braking distance possible. Even for a driver with considerable experience in panic braking, this is usually less than the distance he would need in comparative situations.

In short: The physical limits imposed by the tires and the road surface are almost fully utilized by the ABS.

There is one thing that ABS can't do though and that is go beyond these physical limits. This fact applies to both the braking distance and the maximum speed when cornering.

It remains, as was always the case, the responsibility of the driver to adapt his driving behaviour to the road and weather conditions and to the traffic situation.

The decisive advantage of the ABS is the retention of vehicle manoeuvrability, even during panic-braking during an emergency stop, not only on the straight but also when cornering.

In this way ABS helps prevent accidents.

## 2. Application

The ABS system described in this publication was developed for passenger cars with hydraulic brake systems and is at present being introduced on the market in the upper-class models from BMW and Mecedes-Benz.

On Mercedes-Benz vehicles with a brake circuit for each axle, a 3-circuit system is fitted. Here, the rear-axle brake circuit is controlled by one solenoid valve and one wheel-speed sensor. BMW vehicles with diagonal- control brake systems require a 4-circuit system.

## 3. Operation

The basis of the braking process is the friction existing between the tire and the road surface. In order to brake, the tire must transfer frictional force to the road surface. In doing so, wheel slip develops between the tire and the road surface, i. e. the wheel-circumference speed is less than the vehicle speed.

Figure 2 shows the relationship between frictional force and wheel slip in a typical case on a dry road surface. In the hatched area, the braking force which can be applied to the wheels reaches its maximum. This is the area where ABS control comes into action. As a rule, the frictional force when a wheel is locked, that is, at 100% wheel slip, is less than when the wheel is still turning.

The ABS, therefore, has to maintain the braking pressure in the wheel brake cylinder at precisely the right value in order that the wheel-slip remains in the hatched area because it is here that the highest frictional force is available.

At the same time, sufficient cornering force remains for steerability and directional stability.

The degree of wheel-slip at which the maximum frictional force is present, as well as the frictional-force value itself, depend mainly on the tires (type, pattern, rubber mixture), on the road (material, surface, wet, ice), on the vehicle speed and on the slip angle of the wheels.

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.


K10

K10

The ABS registers the momentary adhesion between the tires and the road surface continuously. It adjusts to every change in the frictional connection between the tires and the road surface, and uses the highest adhesion coefficient possible without causing the vehicle to skid due to wheel lock-up.

The ABS takes into account differences in adhesion between the individual tires and the road surface, as well as sudden changes in the road surface due for instance to patches of ice.

## 4. Construction

The ABS comprises the following main components: Controller, hydraulic modulator, wheel-speed sensors and wiring harness. The individual main components are described in the following.

### 4.1 Wheel-speed sensor

The speed of rotation of the wheels is determined by inductive sensors and passed to the electronic controller in the form of an electric signal.

### 4.2 Electronic controller

This is a small multi-channel electronic computer which evaluates the electric signals from the wheel-speed sensors, which are proportional to the rotational speed of the wheels, and calculates the data on wheel acceleration, wheel deceleration and wheel-slip. The control commands for the solenoid-operated valves in the hydraulic modulator are derived by means of logical configuration of this data.

It is the signal processing in the computer which determines the closed-loop control characteristic of the system. The expected high reliability has been achieved by the application of digital techniques and high-density integrated circuits.

#### 4.2.1 Monitoring system

In order to comply with the increased requirement for safety, the controller is equipped with electronic monitoring circuits which test the system for correct functioning before the commencement of each journey, and continuously check the ABS wiring harness and its component assemblies during the journey. If the monitoring system registers a fault in the controller, in the wiring harness or in the electrical stages of the component assemblies, it switches the ABS off. The conventional, non-ABS controlled brake system remains in use. The driver is notified of this state by a warning lamp in the instrument panel.

### 4.3 Hydraulic modulator

The hydraulic modulator is provided with three-way directional-control valves for the control of the braking pressure in the wheel brake cylinders. These valves permit three states of braking pressure: Pressure increase, pressure maintained constant, pressure decreased. Depending upon the demands posed by the required control characteristic, and upon the adhesion between the road and the tires, the three different pressure states or phases are adapted correspondingly in both their order and duration of operation. In principle, the ABS control process proceeds as follows. As soon as wheel deceleration or slip indicates that a wheel is about to lock, the braking pressure is at first maintained constant. If it is still evident that the wheel is about to lock, then the pressure is reduced until the wheel accelerates or comes back inside the wheel-slip limit again. Finally, the pressure is increased again and the control cycle begins anew.

An electrically driven return pump feeds the brake fluid which is released by the wheel brake cylinder during pressure reduction back into the appropriate brake circuit.
The return pump is of the double piston type in order that the brake circuits of a dual-circuit braking system remain fully isolated from each other.

### 4.4 Wiring harness

The controller is connected to the wheel-speed sensors and the electrical stage of the hydraulic modulator by means of a wiring harness for the purpose of signal input, command output and power supply.

## 5. Fitting in the vehicle

The wheel-speed sensors consist of a coil core with permanent magnet and are fitted to the stub axle or the wheel hub.

Three-circuit systems are equipped with a wheel-speed sensor for the rear axle which is fitted in the differential.

Each wheel-speed sensor is allocated a gear wheel which passes by the permanent magnet reference point of the sensor. The gear wheel is fitted in either the vehicle wheels or the differential.

The hydraulic modulator is mounted in the engine compartment and has been incorporated in the conventional braking system. The electronic controller is in the passenger compartment.

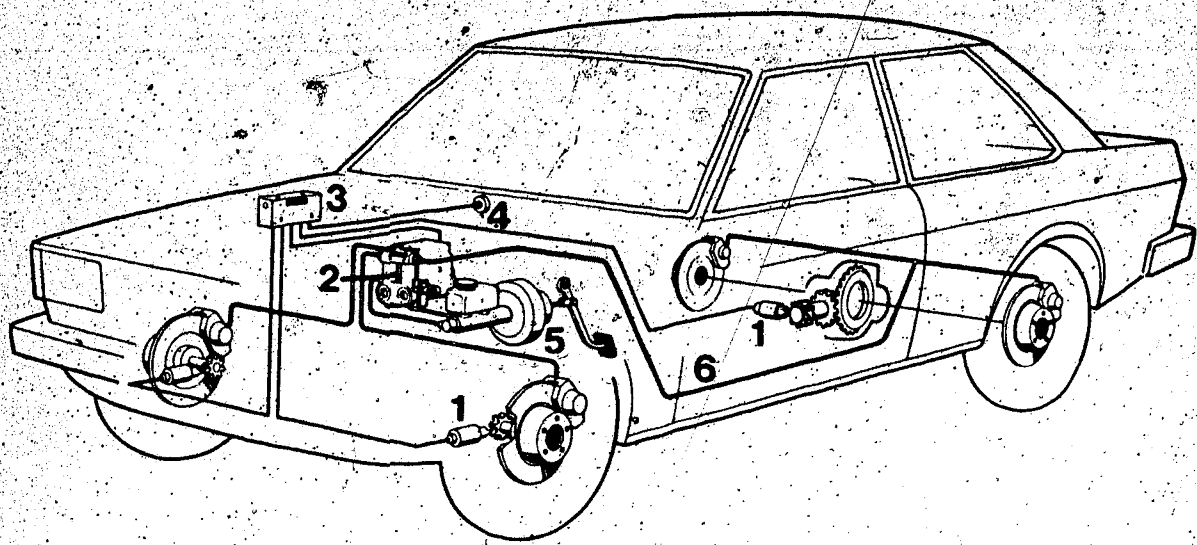


Figure 1

1 = Wheel-speed sensor
2 = Hydraulic modulator
3 = Electronic controller
4 = Warning signal
5 = Brake master cylinder
6 = Brake line

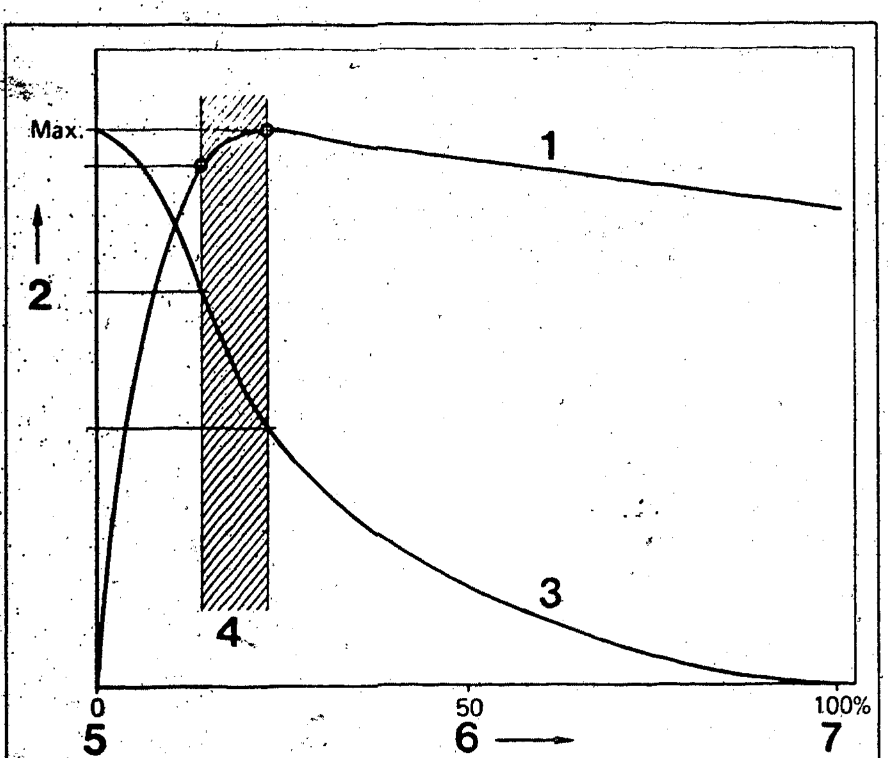


Figure 2

Frictional force and cornering force with reference to wheel slip (Example)

1 = Frictional force in driving direction
2 = Frictional force and cornering force
3 = Cornering force
4 = ABS control range
5 = Wheel turning
6 = Wheel slip
7 = Wheel locked

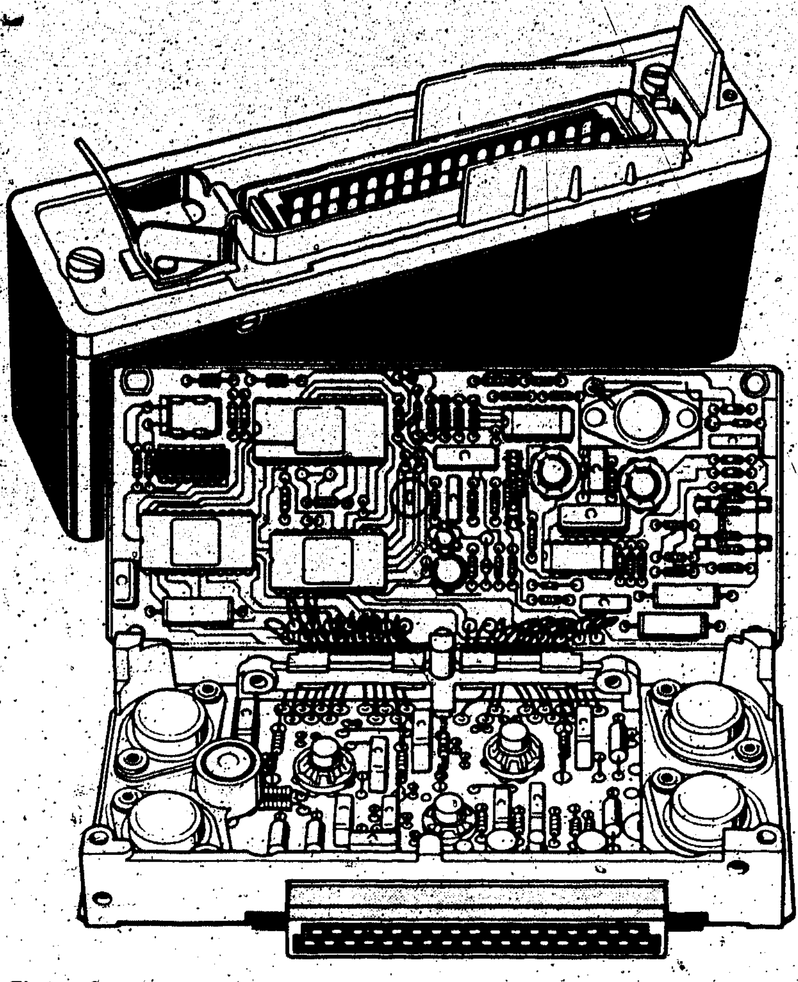

Figure 3

Electronic controller

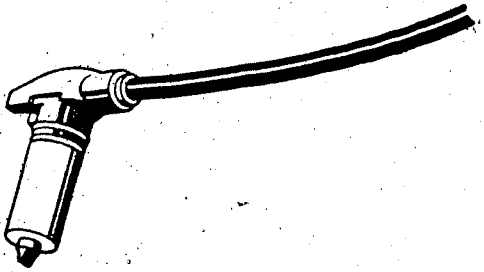

Figure 4

Wheel-speed sensor

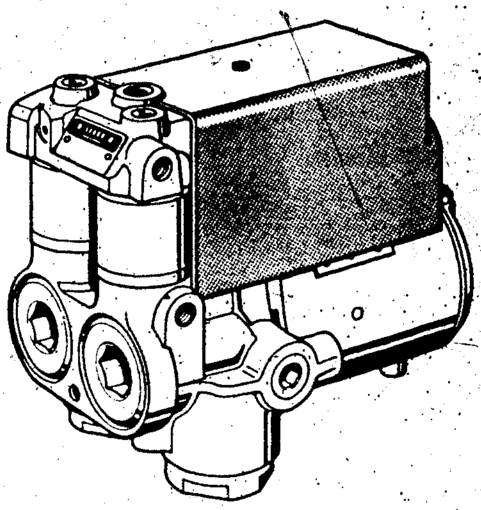

Figure 5

Hydraulic modulator

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K24

ANTISKID BRAKE SYSTEM (ABS) for passenger cars

VDT-I-265/105 En
2.1985

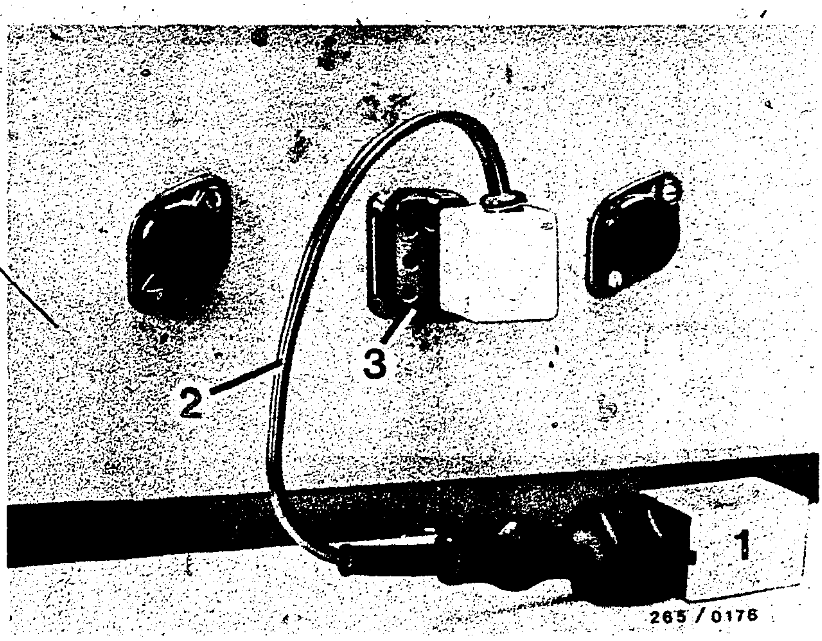
## Over-voltage protection device for the controller

When testing the ABS installation with the Service Tester, in program-switch position 5 (Test Step 6: "Over-voltage protection for the controller") the over-voltage protection relay fitted in the vehicle is to be taken out and plugged into the test plug on the rear of the tester. In the vehicle, the same model of over-voltage protection device is to be plugged in in its place. Round-pin relays are to be plugged directly into the test plug on the rear of the tester, and those with blade terminals are to be plugged in with the aid of the adapter cable 1 468 460 120 (special accessory for Service Tester 0 684 101 600).

Technical Bulletin

The following over-voltage protection relays are in use:

| Vehicle make | K7 part number | Characteristics |
|---|---|---|
| BMW | 1 684 529 027* | 5-pole, integral fuse, blade terminals, fastening clip |
| MB till 9.81 | 1 684 529 020 | 4-pole, integral fuse, blade terminals, fastening clip |
| MB from 9.81 | 1 684 529 024 | 4-pole, external fuse, round-pin terminals |
| Opel | 1 684 529 028 | 5-pole, integral fuse, blade terminals, fastening clip |
| Porsche | 1 684 529 026** | 4-pole, external fuse, blade terminals |
| Volvo | 1 684 529 025** | 5-pole, external fuse, blade terminals, fastening clip |
| VW-Audi | 1 684 529 027*** | 5-pole, integral fuse, blade terminals, fastening clip |
| | 1 684 529 029 | 5-pole, integral fuse, blade terminals |




1 = Over-voltage protection relay
2 = Adapter cable 1 684 460 120
3 = Test plug

* Only for vehicles of the 300 series. On the vehicles of the 500, 600, and 700 series, the over-voltage protection is integrated in the electronic controller

** Turn the plug of the test cable through 180° and plug into the test plug on the rear of the tester. The test cable plug must be offset by one row of pins as shown in the figure.

*** Interchangeable replacement for 1 684 529 022.

Availability

Federal Republic of Germany: This part is new in the K7 product line, and is to be obtained in the normal manner through the K7 specialist wholesaler (BG).

Countries other than Germany: To be obtained through our authorized representative in your country.

Please direct inquiries and comments concerning the contents to our authorized representative in your country

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L1

# After-sales Service

## Technical Bulletin



NEW DATE OF MANUFACTURE FROM 1980
for Bosch products

VDT-I-Gen. 027 En
3.1980
Replaces VDT-BMA 032/5 En

Every ten years the figures denoting the month change in the date of manufacture (FD) for Bosch products.

In the years 1980 - 1989 we shall be using the month-figures 41 - 52 for January to December.
Some products are only marked with quarterly figures (e.g. spark plugs and nozzles). Since the third quarter of 1978, the quarterly figure used has been the FD of the second month of the appropriate quarter.

In front of the month-figures in the three-figure FD number, we give the year-figure, so that Bosch products from 1980 onwards will receive the following dates of manufacture (as a reminder we have quoted the FD for 1979):

| | (1979) | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 921 | 041 | 141 | 241 | 341 | 441 | 541 | 641 | 741 | 841 | 941 |
| February | 922 | 042 | 142 | 242 | 342 | 442 | 542 | 642 | 742 | 842 | 942 |
| March | 923 | 043 | 143 | 243 | 343 | 443 | 543 | 643 | 743 | 843 | 943 |
| April | 924 | 044 | 144 | 244 | 344 | 444 | 544 | 644 | 744 | 844 | 944 |
| May | 925 | 045 | 145 | 245 | 345 | 445 | 545 | 645 | 745 | 845 | 945 |
| June | 926 | 046 | 146 | 246 | 346 | 446 | 546 | 646 | 746 | 846 | 946 |
| July | 927 | 047 | 147 | 247 | 347 | 447 | 547 | 647 | 747 | 847 | 947 |
| August | 928 | 048 | 148 | 248 | 348 | 448 | 548 | 648 | 748 | 848 | 948 |
| September | 929 | 049 | 149 | 249 | 349 | 449 | 549 | 649 | 749 | 849 | 949 |
| October | 930 | 050 | 150 | 250 | 350 | 450 | 550 | 650 | 750 | 850 | 950 |
| November | 931 | 051 | 151 | 251 | 351 | 451 | 551 | 651 | 751 | 851 | 951 |
| December | 932 | 052 | 152 | 252 | 352 | 452 | 552 | 652 | 752 | 852 | 952 |

Please give the exact date of manufacture of defective products on all guarantee claims, since this detail is of great importance for quality monitoring and control.

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# New Product

## COMPUTER-AIDED TRANSMISSION SHIFT

In cooperation with BMW and Zahnradfabrik Friedrichshafen (ZF), Bosch has developed an electronic shift control for a ZF automatic gearbox (type designation 4HP-22E). This control has been fitted as series equipment in the BMW 7451 since May 1983, and since September 1983, it is available as an optional extra for the models 635 CSi, 732i and 735i.
The system is based on a hydraulically controlled 4-speed automatic gearbox. The application of the electronic control to it means that optimum performance is achieved.

The computer-aided transmission shift is combined with Motronic and forms a drive concept that provides best-possible fuel-consumption, power and comfort.

The advantages are:

- Gear changes are soft and jerk-free due to the precise electronic control.
- Fuel consumption is reduced compared to conventional automatic gearboxes due to optimum shift curves and control of converter lockup.
- A safety factor is introduced for the vehicle occupants and for the vehicle and transmission, because the electronic control prevents dangerous gear shifts which would otherwise result from driver errors and/or functional defects.
- Limp-home facility effective in case of system defects.

### Principle of the computer-aided transmission shift

Using sensors, the gearbox output speed, the engine load and the engine speed are determined. In addition, the positions of the position switch on the shift lever, as well as the program switch and the kick-down switch are detected and input to the control unit in the form of an electrical signal. Using a given program, the microcomputer processes this information and determines the most favorable gear. It also controls the switching of the converter lockup and the modulation pressure for the multi-plate clutch, the result is smooth transmission shift at all driving modes.

When the computer-aided transmission shift facility is combined with the Motronic, some sensors can be used for both systems. Such sensors are those for engine speed, load and engine temperature.

An inductive-type sensor which scans the teeth of the flywheel ring gear is used to provide the signal for the engine speed. The engine-load signal is taken from the air-flow sensor and the throttle-valve switch (idle and full-load). Engine-temperature signals are provided by the temperature sensor (NTC II) in the coolant.

Gear-shift program

Basically, the selection of the most appropriate gear depends upon the vehicle speed and the engine load. Gear shift takes place automatically. The driver has the choice though between three different gear-shift programs:

a fuel-economy program (E),
a high-performance program (S) and
a direct-shift program (3-2-1).

The E (Economy) program is designed for minimum fuel consumption.

With the S-program, the gear-shift curves are moved to provide higher load and engine-speed shifting points. By shifting-up at a higher engine speed, maximum acceleration and maximum performance are made available to the driver.

The direct-shift program only permits the vehicle to be driven in the gear that has been selected, unwanted shifts are prevented. This means, for instance, that the position-switch setting 3 on the shift lever is suitable for starting-off in winter when the road surface is slippery.

Improvement of gear-shift quality

The pressure applied at the friction elements is adapted to the particular input moment of the gearbox by the modulation-pressure control. The modulation pressure itself is controlled by the current through the pressure regulator, the control unit calculating and regulating this current depending upon the engine load.

An important feature of the pressure regulator is the fact that when no current is applied to it, e.g. if the electronic circuitry breaks down, it delivers maximum pressure and in doing so prevents destruction of the friction elements in the gearbox.

The gear-shift quality is further improved by changing the ignition point at the engine.

During the gear shift, the engine moment is reduced for a precisely calculated length of time by shifting the ignition point in the retard direction. This reduction of moment depends upon the type of gear change (shift-up, shift-down, load and overrun gear-shift) and the gear which is engaged at the time.

The brief change of ignition point provides a high degree of gear-shift sophistication. It also reduces the duration of clutch slip (loss work) and makes it possible to transfer the same power with a smaller clutch.

Converter-clutch control

The gearbox losses can be reduced to a minimum by means of the converter lockup facility. It suffices to switch-in the electronically controlled converter lockup clutch in 3rd. or 4th. gear. Switch-in takes place independent of car speed and engine load.

Different gear-shift curves are stored in the control unit for the different programs. When the gearbox is cold, the converter lockup does not take place.

Actuators

The hydraulic unit is an integral part of the gearbox, and incorporates the electro-hydraulic converters.

In addition to the pressure regulator, 4 electrically controlled solenoid valves are used for gear selection, converter lockup and reverse-gear interlock. The solenoid valves convert the electronic switching commands into hydraulic functions by blocking, or releasing, a flow of oil.

The gearbox, including the hydraulic unit and the components fitted inside it, is not to be sent to the Bosch after-sales organization for repair. Exchange gearboxes can be used instead.

Safety features

In addition to the optimization of the gear-shift programs and gear-shift sophistication, particular attention was paid to the realization of a variety of safety functions.

+ A downshift safeguard ensures that if there is a defect in the system (e.g. defective rotational-speed sensor), shift-downs are impossible if the speed is excessive.

+ An electronic downshift lock prevents the driver from shifting down at excessive speeds into 3rd., 2nd. or 1st gear.

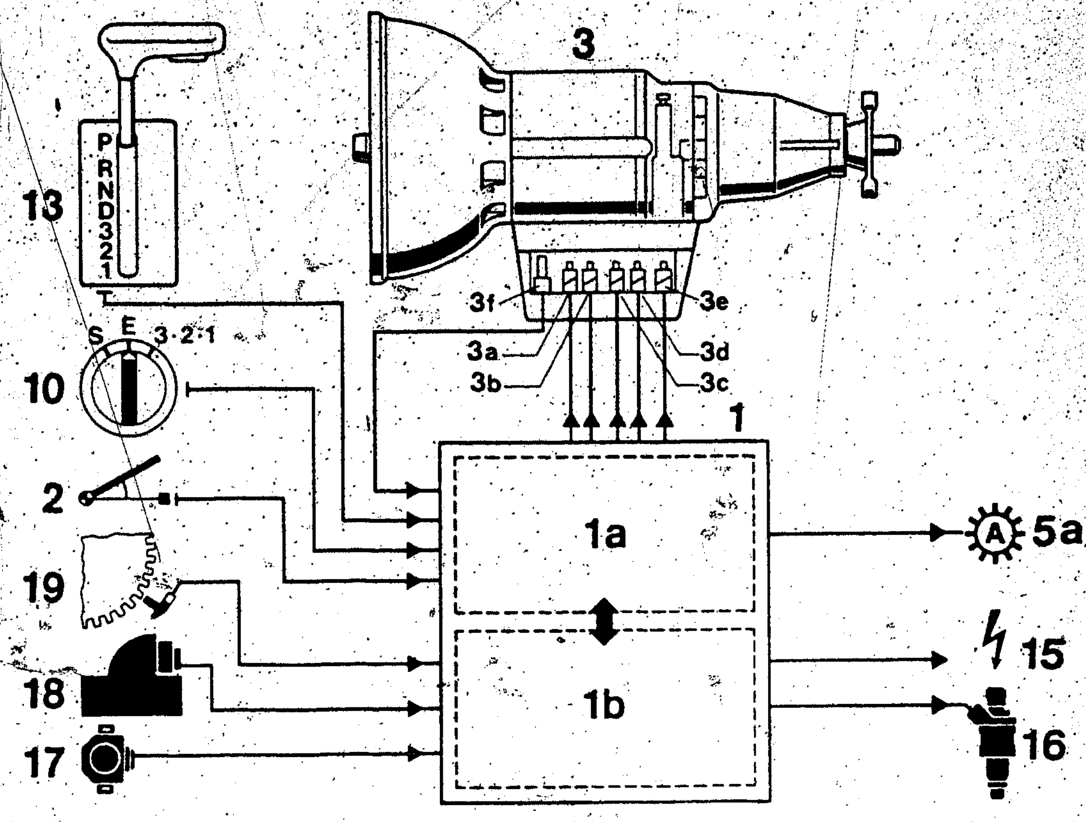
+ An engine overrev safeguard prevents the engine from overrevving when in the overrun mode.

+ A limp-home circuit ensures that the vehicle can still be driven if a functional defect should occur.

If the safety circuit should respond, the fault indication lights up. A relay now switches off the voltage supply to the solenoid valves and to the pressure regulator. This causes the 3rd. gear to be engaged, the modulation pressure assumes its maximum level and the converter lockup is released if appropriate.

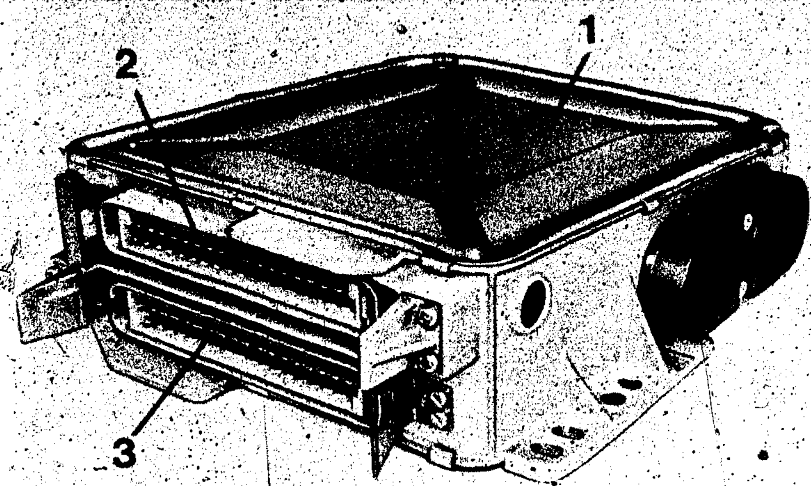
The reverse gear can still be engaged by means of the position switch, but the reverse-gear interlock is no longer effective.

Every time the engine is started, a self-check of the safety circuitry takes place automatically. Fault indications are only erased when the function has been restored to full working condition.




Basic diagram

| | | | |
|---|---|---|---|
| 1 | = Electronic control unit (ECU) | 3f | = Output-speed sensor |
| 1a | = Transmission-shift control | 5a | = Fault indication for computer-aided transmission shift |
| 1b | = Motronic | 10 | = Program switch |
| 2 | = Kick-down switch | 13 | = Shift lever with position switch |
| 3 | = Gearbox | 15 | = Ignition |
| 3a+3b | = Solenoid valves for gear change | 16 | = Fuel-injection |
| 3c | = Solenoid valve, reverse-gear interlock | 17 | = Throttle-valve switch |
| 3d | = Solenoid valve, converter clutch | 18 | = Air-flow sensor |
| 3e | = Pressure regulator | 19 | = Engine-speed sensor |




1 = Control unit for the Motronic and computer-aided transmission shift

2 = Plug-in connection for computer-aided transmission shift (35-pin)

3 = Plug-in connection for Motronic (35-pin)

M3

# BMW 2000 tii and 2002 tii

**with mechanical gasoline injection**



From May 1971 till Juli 1975 BMW equipped the engines of vehicle types 2000 tii and 2002 tii as well as the corresponding "Touring" models with mechanical gasoline injection. The 2 l 4-cylinder in-line engine is identical for all types. At a rated speed of 5800 rev/min the engine delivers 96 kW (130 HP). Firing sequence 1-3-4-2. Idle speed 900 ... 950 rev/min. The ignition point is set without vacuum at 25° btdc at a rotational speed of 2900 rev/min.

## 1. Fuel-Injection Equipment

These gasoline-injection pumps are known by the name "Kugelfischer" from the former company Schäfer Einspritztechnik.

| | | |
|---|---|---|
| **2000 tii** | | |
| Fuel-injection pump | PL 04-124.01 B | 8 492 004 011 |
| **2002 tii** | | |
| Fuel-injection pump | PL 04-124.01 B | 8 492 004 011 |
| or | PL 04-124.01 C 1 | 012 |
| **for both types** | | |
| Injection valve | DL 020 D | 8 492 801 227 |
| Valve insert (supporting device) | | 8 492 809 031 |
| Opening pressure | 30 + 8 bar gauge pressure | |
| Relay for cold starting | 5.71–3.74 | 0 335 330 001 |
| Relay for cold starting | 4.74– | 003 |
| Start valve | 8.73– | 0 280 170 024 |
| Fuel pump | | 0 580 364 002 |

## 2. Explanation of Type Designation

P L 0 4- 124. 01 C 1

- 1 — Internal modification number. Pumps with other numbers are interchangeable.
- C — Modification letter. Pumps with other letters are **not** interchangeable.
- 01 — Engine type identification number
- 124. — Engine manufacturer identification number
- 4- — Number of cylinders
- 0 — Without helix, with stroke regulation
- L — Light oil
- P — Pump

**BOSCH**

Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.


M4

## 3. Description of Fuel-Injection System

With these fuel-injection pumps the quantity of fuel injected is metered by direct coupling of the control cam of the pump with the throttle valve and a magnetic eddy-current sensor for speed-dependent fuel-delivery correction. No special device is required for acceleration.

The fuel-injection system comprises:

Fuel-injection system with control system
Cold-start device
Warm-up device
Injection valve
Fuel pump

The **fuel-injection pump** comprises:

Pump housing, camshaft with built-in rotational-speed sensor, sliding tappet and plunger return springs, three-dimensional control cam, governor mechanism and spring, eccentric-mounted control swiveling arm.

Cylinder block, plunger and plunger return springs, suction valves, delivery-valve assemblies, fuel-pressure-retaining valve.

The course of the stroke of the sliding tappet is determined by the cam contour, the top dead center of which is designed as a rest over a large angular range. The downward motion of the plunger is that of the sliding tappet as far as the lower rest position of the plunger. While the sliding tappet continues to follow the cam face, the plunger rests on the control swiveling lever. As the sliding tappet begins to move up again the plunger is carried along until it once more reaches its top dead center position.

The fuel delivery is controlled by altering the plunger lift. Only the lower rest position is adjusted, so port closing is variable, while port opening is constant. The suction stroke is limited. During the delivery stroke the fuel quantity drawn in previously is delivered. The lower rest position of the plunger is determined by the control swiveling lever, the position of which can be varied in the direction of the plunger lift motion. The control swiveling lever is designed as a one-armed lever mounted on the eccentric shaft. Its free end is supported on the control cam via the feeler pin. The lower rest position of the plunger can be influenced independently from two sides.

The quantity of fuel injected is controlled in operation by sensing the radial elevation of the three-dimensional control cam. This cam is displaced longitudinally by the control lever and, due to the coupling between the control lever and throttle valve, is dependent on the position of the accelerator pedal, i.e. load-dependent at constant rotational speed. The angle of the control cam is adjusted by the governor via the governor mechanism so that a certain angular position of the control cam corresponds to each rotational speed. The built-in rotational-speed sensor in the camshaft generates a speed-dependent moment which is in equilibrium with the counter-moment of the governor spring (spiral spring).

**Cold-start Device**

When the starting motor is actuated a solenoid-operated valve causes the increased quantity of fuel required for cold starting to be injected into the induction system.

**Warm-up Device**

The extra quantity of fuel and air required during the warm-up phase is controlled as a function of the cooling-water temperature via an expansion element. As the cooling-water temperature increases, this element continuously reduces the quantity of fuel injected after cold starting by rotating the eccentric shaft with which the control swiveling lever is lifted. Simultaneously, the air-regulating cone is displaced so as to reduce the required auxiliary air for idling accordingly.

**Injection Valve**

The injection valve is a mitre valve which opens toward the combustion chamber and which is drawn into the valve seat by a pendulous double extension spring.

**Fuel Pump**

Roller-cell pump 0580364002 is used.

## 4. Removal of Fuel-Injection Pump

This and the following sections will refer only to deviations from or remarks on generally known procedures.

Drain the cooling water. Remove the dust protection cover for the pump drive gear. Set cylinder 4 to ignition top dead center. Unscrew the fastening nut of the pump drive gear. Remove the pump drive gear. Withdraw the fuel-injection pump from the gearbox cover until the jack shaft at the warm-up-sensor housing can be removed. Remove the fuel-injection pump.

## 5. Installation of Fuel-Injection Pump

Installation is performed in the reverse sequence of operations. Clean the strainer in the inlet-union screw of the fuel supply pipe. Ensure that the hose clamp on the fuel return hose is to the front and vertical otherwise the protective cap may be blocked by the enrichment lever.

The engine is still with cylinder 4 at ignition top dead center. Cylinder 4 is at the clutch end. Rotate the pump camshaft until the keyway points to the center of the cylinder block. This is the port opening of the 1st pump barrel, which is at the drive end.

The fuel system bleeds automatically.

## 6. After-sales Service Information

### Injection Valves

The opening pressure of the injection valves is 30 + 8 bar gauge pressure. The minimum permissible opening pressure is 15 bar gauge pressure. At a gauge pressure of 15 bar no drops should form after 5 seconds. Prior to each test the injection valve should be thoroughly scavenged by rapidly actuating the nozzle tester. The opening pressure cannot be adjusted.

### On-the-vehicle Adjustment of Warm-up Sensor

The warm-up device should only be adjusted when cold. Remove the air-filter housing complete. Use a screwdriver to force out the air-regulating cone until setting gauge KDEP 2759 can be inserted in the groove in the air-regulating cone. The distance between the full-load stop screw and full-load stop at the housing should be 2.6 ± 0.3 mm. Any corrections should be made at the plate nut on the warm-up sensor. Adjust the engine idle. Re-test at operating temperature. The air-regulating cone must protrude at least 9 ... 10 mm from the collar nut. The full-load stop screw must be in contact with the full-load stop at the housing. The distance between the enrichment lever and plate nut on the warm-up sensor must be 4 mm. If these values are not reached, the expansion element is probably defective and the warm-up sensor must be replaced.

### Synchronization of Throttle Valve with Fuel-Injection Pump

**Basic Setting**

The connecting rod between the control lever and reverse-transfer lever must be set to 85 mm, in each case center of locating hole for ball heads. If necessary, manufacture a gauge as per Fig. 2.

Adjustment of throttle linkage and full-load stops.

Remove pivot pin (1) from reverse-transfer lever (2). Adjust the tie rod and connecting rod to 289 mm and 85 mm respectively (as per Fig. 2).
Firmly locate pump control lever (3) with the 5 mm dia. draw hook (as per Fig. 3) in the lower slot. Adjust stop screw (4) such that pump control lever (3) is just contacted. Press accelerator pedal (5) against full-load stop (6). Adjust pivot pin (1) such that it can be suspended stress-free in the hole in reverse-transfer lever (2). Secure the pivot pin and remove the draw hook from the pump control lever.

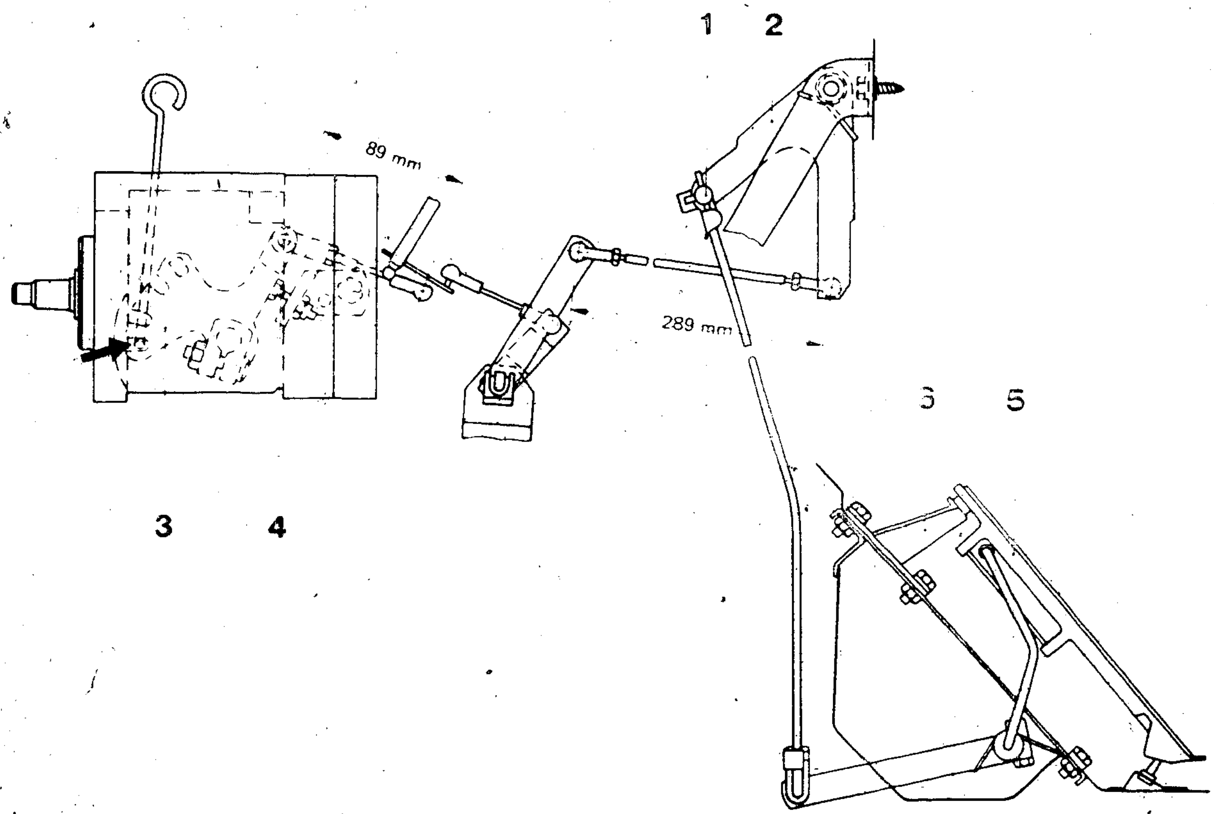



Fig. 1

**Synchronization**

Remove the cover from the throttle-valve assembly. Unscrew the adjusting screw (next to the vibration pipe of cylinder 2) until the eccentric is no longer contacted. Loosen the 2 clamp screws below the throttle-valve assembly. Using a 5 mm dia. hook (if necessary, manufactured as per Fig. 3), firmly locate the pump control lever through the upper slot in the hole in the pump housing. Insert a 4 mm dia. dowel pin (if necessary, manufactured as per Fig. 4) into the hole between the eccentric and housing. Press the eccentric against the dowel pin. Press the eccentric downward and retighten the 2 clamp screws below the throttle-valve assembly. Remove the dowel pin and hook from the control lever. Synchronization is correct if the eccentric slightly covers the hole for the dowel pin. Using the adjusting screw on the exterior of the housing next to the 2nd vibration pipe, adjust the idle speed to 900 ... 950 rev/min. Secure the adjusting screw.

**Full-load Adjustment**

Remove the vibration pipe from cylinder 1. Firmly locate the control lever in the lowermost slot in the pump housing, using a 5 mm dia. hook. Adjust the full-load stop screw such that the control lever is just contacted.

**Testing of Start Valve**

**Testing of Thermo-time Switch**

**Testing of Electronic Timer**

These tests are described in Service Information VDT-I-BMW 001.

## 7. Repairs

The fuel-injection pump should never be completely disassembled without adequate knowledge or the repair instructions and appropriate special-purpose tools. At most the cylinder block may be removed so that the pump interior can be subjected to a visual examination and, if necessary, cleaned.

## 8. Testing

A normal Bosch injection-pump test bench can be used to test the fuel-injection pump. Normal calibrating oil may also be used. However, ensure that it is perfectly clean.

To ensure that the idle settings actually correspond to the engine idle, the governor is now adjusted at a rotational speed of 500 rev/min. For this purpose the governor gear has an additional mark "5" = 500 rev/min. The basic stroke is also set at this mark "5".

If a new pump housing has been used, the mark for adjusting the governor is to be determined as follows:
Bring the governor gear to the stop in the idle direction. Turn back the governor shaft by 4.7 teeth and then transfer the governor gear mark for a rotational speed of 350 rev/min to the pump housing.

**Functional Test on Governor**

Test speeds: 500, 1400 and 2800 rev/min

Tolerances: No tolerance at a rotational speed of 500 rev/min. At speeds of 1400 and 2800 rev/min the tolerance zone is indicated in each case by 2 adjusting marks on the small governor gear.
The marks on the governor gear signify the following: 5 = 500 rev/min, 2 marks closely together = 2800 rev/min, 2 marks slightly further apart = 1400 rev/min.

Hysteresis (governor friction): when testing with increasing and decreasing rotational speeds at 500 rev/min averaged at 1/2 tooth. Within the tolerance zone at rotational speeds of 1400 and 2800 rev/min. An adjusting mark is scratched in on the left-hand side of the governor housing as a basis for checks.

**Governor Adjustment**

The governor is adjusted with the pump mounted. The cylinder block must also be mounted.
Operate the test bench at a rotational speed of 500 rev/min and alter the length of the spring on the clamping piece until the mark "5" coincides with the mark in the pump housing. Operate the test bench at a rotational speed of 1400 rev/min and check whether the mark is within the tolerance zone for 1400 rev/min at the gear. If not, the preload must be altered accordingly by rotating the spring gear with the clamp screw loosened and the governor gear locked. If the deviation from tolerances is excessive, the length of the spring must be altered once more and fine adjustment be made by modifying the spring load. The same procedure should be followed for a rotational speed of 2800 rev/min. This alternating adjustment is to be performed until all points lying within the tolerances specified on the governor gear agree.

## 9. Test Specifications

Direction of rotation:
clockwise looking at drive end.

Stroke at idle speed:
0.42 ± 0.005 mm at mark "5" and control lever slotted into appropriate hole at idle speed.

Firing sequence:
1-3-4-2

Supply pressure:
1.4 to 1.6 bar gauge pressure

Fuel delivery in $cm^3$/1000 strokes and cylinder
Hysteresis 0.8 $cm^3$ and scatter 0.8 $cm^3$/1000 strokes

| Position of control lever | Rotational Speed rev/min *) | Fuel Delivery $cm^3$/1000 strokes | Remarks |
|---|---|---|---|
| Idle | 500 + | 12.0 ... 13.6 | Control lever 1st hole |
| Idle | 1400 U | 0.0 ... 0.4 | Control lever 1st hole |
| Part load 1 | 1400 + | 17.7 ... 19.4 | Control lever 2nd hole |
| Full load | 2800 U | 54.0 ... 56.7 | Control lever 4th hole |

*) + These rotational speeds are to be approached once from above and once from below. U is to be approached only from below.

## 10. Tools

Various after-sales service tools are required to repair this fuel-injection pump. Basically these tools are ordered in the same manner as all other after-sales service tools. Offer sheet KDEP 17 B of 1.77 is available.

Testing tools are developed by the K 7 Division, Workshop Equipment. Please contact K 7/VKF 1 if necessary. An offer sheet was issued in 1976.

## 11. Service Parts

Service-parts lists are available on microfiche. Service parts are to be ordered in the customary manner.

## 12. Exchange

The gasoline-injection pumps available on an exchange basis are listed on the microfiche for exchange products.

## 13. Warranty

Bosch warranty periods and procedures with which you are conversant apply in accordance with the Bosch Warranty Manual.

Date of Manufacture (FD)
The date of manufacture is specified on the cylinder block by way of a letter and the names of the months ranging from 1 to 12.

V = 1972, W = 1973, X = 1974, Y = 1975, Z = 1976
1 to 12 = January till December

Please change the code of these dates of manufacture in accordance with the Bosch Warranty Manual.
Example: W 5 = 1973, May = 325 or
Z 3 = 1976, March = 623

Defect Numbers
Until the list of defect numbers has been published, please state defect number 10 and explain the detected defect on a clearly written slip of paper.

## 14. Technical Documentation

Repair and test instructions will be published at a later date.
The test-specification sheet is included in this Service Information in provisional form.
Service-parts lists are available on microfiche.
Offer sheet for after-sales service tools KDEP 17 B of 1.77 is available.
Offer sheet for testing tools was issued in 1976.
Service Information VDT-I-BMW 001 with information regarding the testing of the start valve, thermo-time switch and electronic timer is available.
Exchange products are detailed on microfiche WB-00.

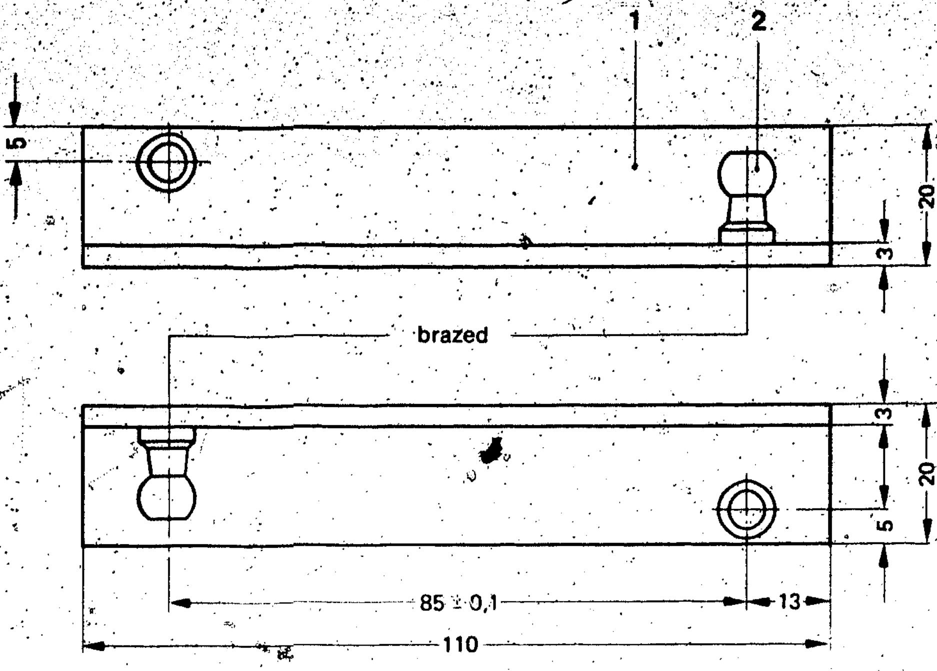



Fig. 2

| Qty. | Designation | Part No. | Material | Base Dimensions | Remarks |
|---|---|---|---|---|---|
| 2 | Ball studs | 2 | B 8 x 4 DIN 71803 | L 20 x 3 x 112 | 8 492 530 635 |
| 1 | Holder | 1 | St 37 DIN 1028 | | |

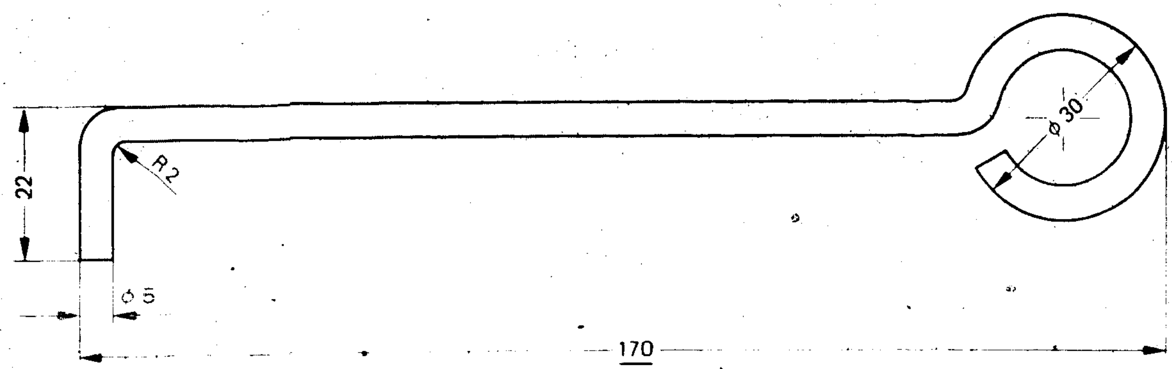



Fig. 3

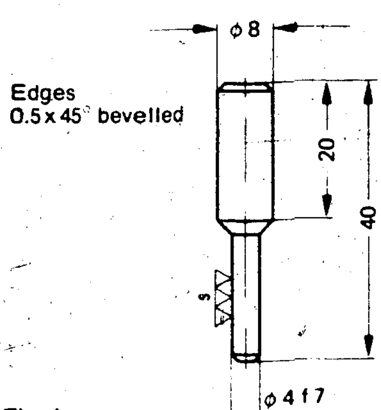



Fig. 4

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M10

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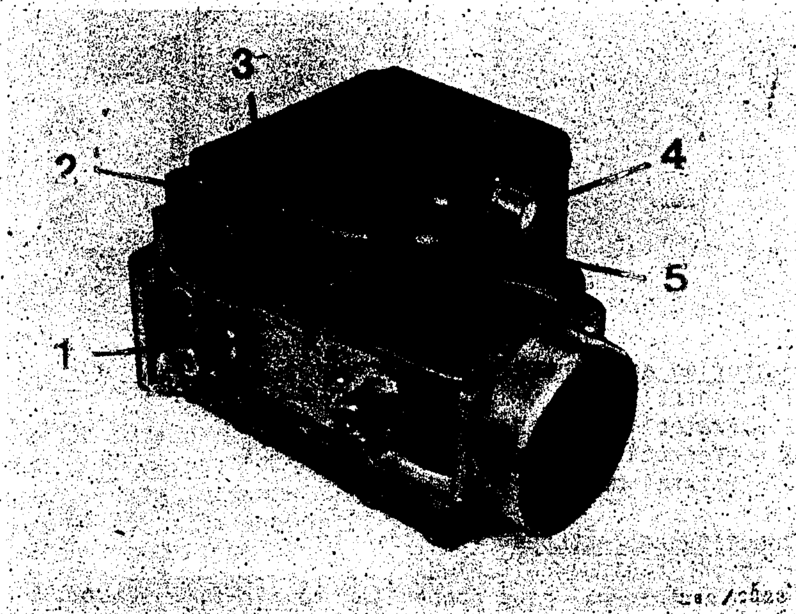
Register tab 4 Systems
File Identity VDT-I-KFZ / 8 En

NEW SYSTEM

L 3 - Jetronic

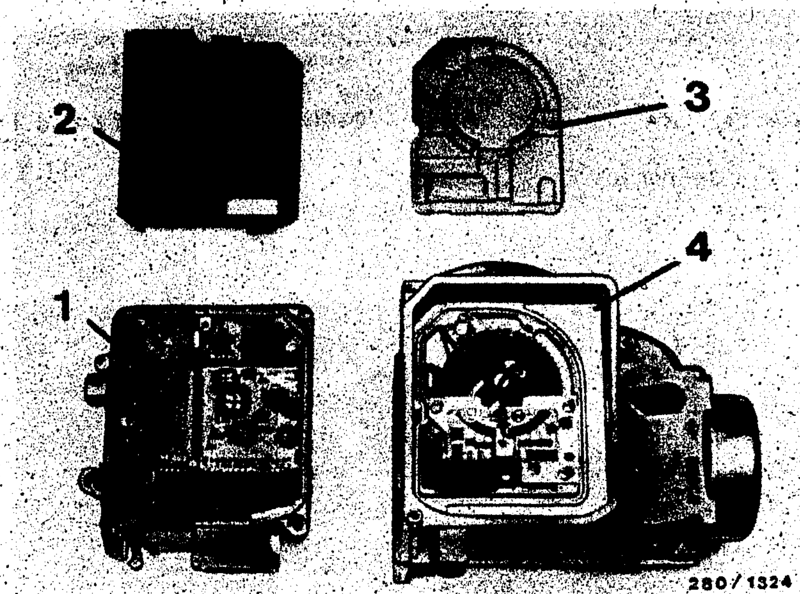
11.1986




Measuring and control unit
1 = Air-flow sensor
2 = Control unit
3 = 15-pin control-unit plug
4 = Closure cap of CO adjusting screw
5 = Protective cap of connecting screw

The L3-Jetronic is a further development of the conventional LE- and LU-Jetronic.
Through a high assembly density of the components and digital circuit technology, it has become possible to mount the control unit directly at the air-flow sensor. The two together form the measuring and control unit.

| | SERVICE INFORMATION | ==> |

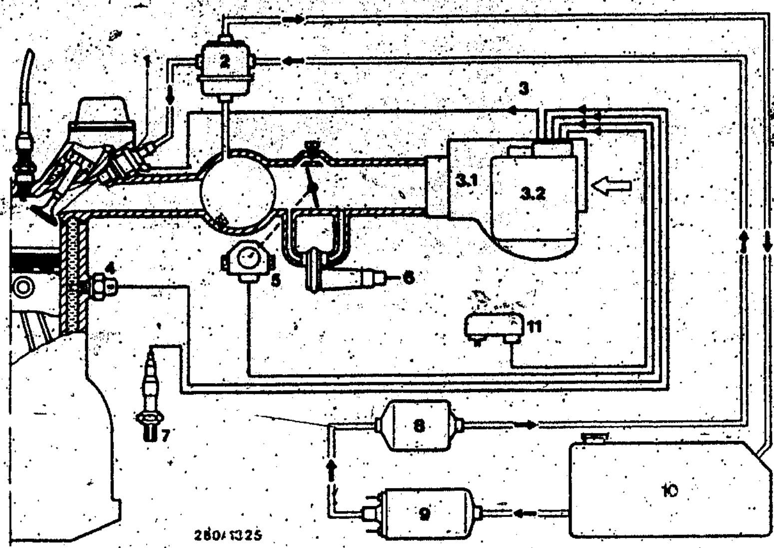



Measuring and control unit opened
1 = Control unit
2 = Protective cover of control unit
3 = Protective cover of air-flow sensor
4 = Potentiometer chamber

Identifying features
* 15-pin control-unit plug
* 4-pin internal plug connection to air-flow sensor.
* CO adjusting screw at control unit.
* Air-flow sensor without bypass duct and CO adjusting screw.
* Less leakage air and improved stability of characteristic curve of air-flow sensor

Characteristics
* The control unit which is suitable for use in the engine compartment is temperature-resistant and splash-proof.

L3 variants
L3.1 without lambda closed-loop control
L3.2 with lambda closed-loop control




Overview of system

1 = Solenoid-operated injection valve
2 = Pressure regulator
3 = Measuring and control unit
3.1 = Air-flow sensor
3.2 = Control unit
4 = Temperature sensor (engine)
5 = Throttle-valve switch
6 = Auxiliary-air device
7 = Lambda sensor (only for L3.2)
8 = Fuel filter
9 = Electric fuel pump
10 = Fuel tank
11 = Altitude sensor

## Possible operating scope of control unit

| Inputs | Operations of both variants | Outputs |
|---|---|---|
| | Start control | |
| Air quantity | Post-start enrichment | Injection valves |
| | Warm-up enrichment | |
| Engine speed | Acceleration enrichment | |
| Engine temperature | Lambda map | |
| | Idle map | |
| Intake-air temperature | Full-load map | |
| | Intake-air correction | Fuel-pump relay |
| | Altitude compensation | |
| Idle | Anti-bucking function | |
| Full load | Air-flow sensor damping | |
| | Pulse-time limitation max./min. | |
| Supply voltage | Overrun cut-off | Air-quantity signal (Up) |
| | Speed limitation | |
| Atmospheric pressure (altitude) | Electric fuel-pump control | |
| | Additive map adjustment | |
| | | Reference voltage ($U_V$) |
| Additive map adjustment (idle CO) | Plausibility check | |
| | Limp-home function | |
| | L3.1 variant | |
| Overrun-cut-off override | Overrun-cutoff suppression | Load signal ($t_L$) |
| | Hot-start function | |
| Data coding | Multiplicative map adjustment | |
| Mult. map adjustment | Load-signal preparation | |
| | | Sensor monitoring |
| Excess-air factor, tv coding | L3.2 variant | |
| | Lambda closed-loop control | |
| Lambda closed-loop control | Preparation: sensor monitoring/test output, lambda closed-loop control | Test output |
| | | Lambda closed-loop control |

<u>Control-unit functions</u> of both variants

* Plausibility check

  If the control unit detects an extreme value, this is replaced by a fixed value.
  Example:
  Detected engine temperature -40°C,
  replacement temperature +80°C
  This applies to the following inputs:
  Engine temperature
  Intake-air temperature
  Altitude sensor
  Idle switch
  Full-load switch

* Limp-home function

  If the program run in the computer is upset, two fixed injection signals are transmitted.
  Idle switch closed: 2.2 ms
  Idle switch open: 2.5 ms
  The injection signal is transmitted with every ignition pulse.

* Additive map adjustment

  The idle injection pulse may be altered via a potentiometer at the control unit.
  This corresponds to the previous CO setting.

* Electric fuel-pump control

  For reasons of safety, no fuel can be delivered when the engine is not running and the ignition switched on.
  Therefore, the pump relay is energized only under the following operating conditions:
  engine running
  starting
  emergency running
  bump start

* Reference voltage ($U_V$)

The reference voltage in the control unit, supply for the air-flow sensor, is made available for further consuming devices, e.g. electronic ignition systems. This output can be loaded with a maximum of 0.1 mA.

* Air-flow sensor signal ($U_P$)
The wiper voltage is brought out for further usage, e.g. electronic ignition systems.

L3.1 variant

* Load signal ($t_L$)
The load signal formed in the control unit is made available for further consuming devices, e.g. consumption indicator.

* Multiplicative map adjustment
The whole map can be altered via this control-unit input.
Input open: normal operation
Input at ground: 5 % enrichment

L3.2 variant

* Lambda closed-loop control (tv coding)
  tv = Response-delay time
  During the response-delay time the control system makes the mixture richer, although the lambda sensor detects a rich mixture.
  Input open : tv1 (standard value)
  Input at ground: tv2

* Sensor monitoring/
  test output, lambda closed-loop control
  The standard function is "sensor monitoring". If the idle switch and full-load switch are short-circuited to ground, the "test output, lambda closed-loop control" function is activated.

  Sensor monitoring
  The following failures are indicated:
  break in lead to sensor.
  Control at rich stop (lean mixture). No change of sensor voltage.

  Test output, lambda closed-loop control
  The position of the integrator voltage is indicated.
  In addition, the output is used for idle-CO adjustment.

Testing
The universal test adapter with the L3-system adapter lead is available for testing.

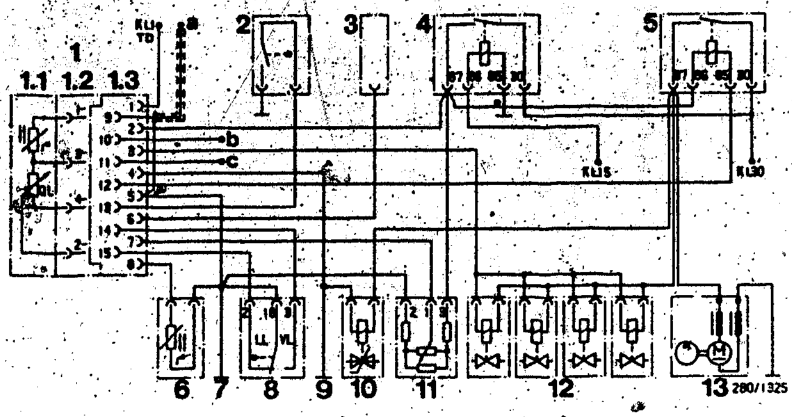
It is a 15-pin, Y-shaped lead with which the peripheral units and the control unit are tested.

Part numbers:

| | |
|---|---|
| Universal test adapter | 0 684 101 801 |
| Y-shaped adapter lead | 1 684 463 168 |

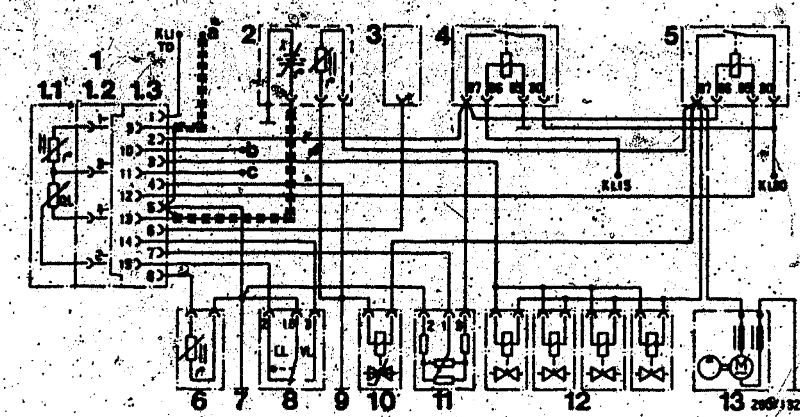
In the case of the L3.2 variant, the self-diagnosis unit is scanned before testing with the universal test adapter.

1- KF218




Electrical terminal diagram
L3.1 variant

1 = Measuring and control unit
1.1 = Air-flow sensor
1.2 = Control unit
1.3 = Control-unit plug
2 = Switch for overrun-cutoff suppression
3 = Connection for multiplicative map adjustment
4 = Main relay
5 = Pump relay
6 = Temperature sensor II (engine)
7 = Ground, electronics
8 = Throttle-valve switch
9 = Ground, output stage
10 = Auxiliary-air device
11 = Pressure sensor (altitude sensor)
12 = Injection valves
13 = Electric fuel pump
a = $U_V$ output, reference voltage
b = $t_L$ output, load signal
c = $U_p$ output, air-quantity signal



<u>Electrical terminal diagram</u>
L3.2 variant

1 = Measuring and control unit
1.1 = Air-flow sensor
1.2 = Control unit
1.3 = Control-unit plug
2 = Heated lambda sensor
3 = tv coding
4 = Main relay
5 = Pump relay
6 = Temperature sensor II (engine)
7 = Ground, electronics
8 = Throttle-valve switch
9 = Ground, output stage
10 = Auxiliary-air device
11 = Pressure sensor (altitude sensor)
12 = Injection valves
13 = Electric fuel pump
a = $U_V$ output, reference voltage
b = Sensor monitoring/
test output, lambda closed-loop control
c = $U_p$ output, air-quantity signal

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

Register tab 4 Systems

L3 - JETRONIC

File Identity VDT-I-KFZ 108 En

After-Sales Service Procedure

12.86

Brief desciption of the system

With the L3 Jetronic, just as with the L2 Jetronic, analagous air-quantity, engine-speed and temperature input signals are processed in a control unit microcomputer.

Special feature:
The air-flow sensor and control unit form a functional unit, but are mechanically separable.

The remaining components correspond to those of the familiar L-LE Jetronic systems.

Users:

As the first automobile manufacturer to do so, OPEL is equipping the Kadett, Ascona and Omega automobiles with the L3 Jetronic system. Series start-up 9.86.

Components:

Air-flow sensor : 0 280 202 602

Control unit : 0 280 000 603,..605

Detailed equipment data is given on the respective vehicle-equipment microcard AP ...

Replacement/exchange parts

Exchange parts - see exchange microcard WB 01 and exchange price list PD 02.

Testing:

Testing of the system in the automobile is carried out with the universal test adapter in conjunction with a special adapter cable and a commercially available multimeter.
Special tools are not required.

Test equipment:

| | |
|---|---|
| Universal test adapter ETT 018.01 | Part No. 0 684 101 801 |
| Adapter cable* | Part No. 1 684 463 168 |

Delivery in the usual manner (specialist equipper BG, RG/AV).

* Also available through BG or RG/AV test equipment rental

Technical documentation:

Trouble-shooting instructions and test specifications:
SIS microcard PKW
(see overview After-sales service information KFZ 000 001).

System training:

Integrated in the L Jetronic and Jetronic Special technical courses.

Retrofitting:

This system is not intended for retrofitting.

**Gewährleistungsabwicklung:**

a) Deutschland

Beanstandete Komponenten sind während der Garantiezeit zur Garantiebeurteilung über den zuständigen BG einzusenden an:

K3/QSG
Wareneingang
am Boschwerk
7000 Stuttgart 30

mit Gewährleistungsantrag G 20
und Lieferschein KH/VKD 3 - 15333

b) Übrige Länder

Beanstandete Komponenten sind während der Garantiezeit zur Garantiebeurteilung der zuständigen Landesvertretung einzusenden.

Verantwortlich:

ROBERT BOSCH GMBH
Geschäftsbereich KH
Technischer Kundendienst (KH/VKD 2)

Anfragen außerhalb der Bundesrepublik Deutschland sind an die jeweilige RG/AV zu richten



N17

HINWEISE ZUR ABWICKLUNG

EINER ORDNUNGSGEMÄSSEN

BREMSENREPARATUR

REGELN

* Räder nicht versetzt montieren. Vor der Demontage kennzeichnen und über Kreuz mit vorgegebenen Drehmoment anziehen.
* Ein Fahrzeug darf nach einer Bremsenreparatur erst dann in Bewegeung gesetzt werden, wenn der Druckaufbau manuell am Pedal überprüft worden ist.
* Bei jeder Reparatur die Bremsflüssigkeit auf Wassergehalt überprüfen, sonst die Wechselintervalle (alle 2 Jahre) beachten.
* Um das Lösen der Bremsen zu gewährleisten, ist beim Austausch des Hauptbremszylinders bzw. des Bremskraftverstärkers das Kolbenstangenspiel zu prüfen und ggf. nachzustellen.

KONTROLLEN

* Die Leichtgängigkeit der Mechanik von:
  - Trommelbremsgestänge
  - Handbremsseil
  - Bremsseil
  - Schwimmrahmen

  ist Grundvoraussetzung für eine ordnungsgemäße Funktion der Bremsanlage.
* Vor jeder Demontage eine Sichtkontrolle durchführen.

  Feuchtigkeit, Tragbild der Scheiben und Beläge sowie Staubansatz lassen Rückschlüsse auf die Funktion der Bremsanlage zu.

REINIGEN

Vorsicht bei der Unterbodenreinigung mit Hochdruckgeräten (Dampfstrahler). Reinigungszusätze sie Silicone oder Wachse können sich in der Bremsanlage absetzen und negative Auswirkungen auf Gummiteile und Beläge haben.
Als Reinigungsmittel für Bremsaggregate darf nur Spiritus verwendet werden.
Vorsicht! Auch Bremsenreiniger können sich negativ auf Gummiteile auswirken.

ENTLÜFTEN

* Bei schräg eingebauten Radbremszylindern ist darauf zu achten, daß der Luftsack zwischen Entlüfterbohrung und dem höher liegenden Kolben möglichst klein ist. Dies wird mit dem gleichmäßigen Zusammendrücken der Kolben erreicht.

* Bei manchen Fahrzeugen mit installierten lastabhängigen Reglern ist die Entlüftung der entlasteten Hinterachse nicht möglich, weil ein Bremskraftregler oder Begrenzer den Durchfluß der Bremsflüssigkeit unterbindet.
  In solchen Fällen muß bei belasteter Achse entlüftet oder das Regelgerät in eine entsprechende Stellung gebracht werden, die den Durchfluß zur Hinterachse freigibt.

* Wird mit einem Füll- oder Entlüftergerät unter zu hohem Druck entlüftet, schießt die Bremsflüssigkeit sehr schnell in die Bremsanlage und bildet Schaum. Wenn sich die Schaumbläschen mit der Zeit zu größeren Blasen zusammengeschlossen haben, wird der Pedaldruck, nachdem er ursprünglich hart war, wieder weich. Ein Nachentlüften ist unbedingt erforderlich.



N19

* Der Bremsflüssigkeits-Vorratsbehälter darf beim manuellen Entlüften nie ganz entleert werden, da die Schmutzablagerungen an den Dichtungen Schäden verursachen können.

* Um eine Zerstörung des Hauptbremszylinders (Primärmanschette) zu vermeiden, ist bei einem manuellen Entlüften nur max. 50% des Pedalweges zurückzulegen.

BREMSBELÄGE

* Bei Scheibenbremsbelägen und Trommelbremsbacken sind generell die Kanten anzuschrägen (ca.45°).

* Beim Erneuern der Scheibenbremsbeläge grundsätzlich die Zubehörteile erneuern, bei den Trommelbremsbacken grundsätzlich überprüfen.

BREMSSCHEIBEN

* Vor der Wiederverwendung Scheibe auf Taumelschlag, Dickenunterschied und Stärke prüfen.

* Bei zu großem Taumelschlag: Radlagerspiel und Scheibenauflagefläche kontrollieren.

TROMMELBREMSE

* Bremsträger (Ankerblech) auf Einlaufstellen und Korrosion prüfen. Auflagelagepunkte immer mit temperaturbeständigem Fett dünn bestreichen.



N20

BREMSSATTEL

* Auf Leichtgängigkeit der Kolben muß beim Zurückdrücken geachtet werden.

* Bei der abgesetzten Kolbenausführung ist darauf zu achten, daß der Kolben nicht verdreht wird, da dies eine Geräuschentwicklung und ein schräges Ablaufen zur Folge hat (senkrecht/ 20°).

RADBREMSZYLINDER

* Beim Einhängen der Bremsbacken kann es gelegentlich vorkommen, daß die Radzylinder plötzlich undicht werden. Grund dieser Undichtigkeit ist das einseitige Zusammenschieben der Kolben, wobei eine Dichtung über die Anschlußbohrung gedrückt wurde.
  Bei der nächsten Bremsbetätigung dichtet diese Radzylinderseite möglicherweise nicht mehr ab.

Verantwortlich:

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Anfragen außerhalb der Bundesrepublik Deutschland sind an die jeweilige RG/AV zu richten.

VOLKSWAGEN GOLF/JETTA DIESEL

mit VE 4/9 F 2400 R 221 und ..R 224 4.1987
(0 460 494 179 und ..185)
Beanstandung wegen Fahrruckeln

Aus dem Feld wurden an diesen Fahrzeugen vereinzelt Beanstandungen wegen Fahrruckeln bekannt. Fahrruckeln ist keine von BOSCH zu vertretende Beanstandung und kann daher nicht als Garantieanspruch behandelt werden.

Abhilfe kann jedoch u.U. bei VE-Pumpen mit FD 646 und älter durch Einbau eines anderen Teillastreglers, Pos.68, geschaffen werden.

| Teillastregler | bisher | neu |
|---|---|---|
| VE ...R 221 | 1 463 161 751 | 1 463 161 780 |
| VE ...R 224 | 1 463 161 677 | 1 463 161 782 |

Die neuen Teillastregler wurden ab Juli 1986 (FD 647) in der Serie eingebaut. Die Ersatzteillisten werden entsprechend geändert. Die Prüfwerte ändern sich nicht.

Das Auswechseln des Teillastreglers ist auch innerhalb der Gewährleistungszeit gegen Berechnung auszuführen.

Verantwortlich:

ROBERT BOSCH GMBH
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Technischer Kundendienst (KH/VKD 2)

Anfragen außerhalb der Bundesrepublik Deutschland sind an die jeweilige RG/AV zu richten.